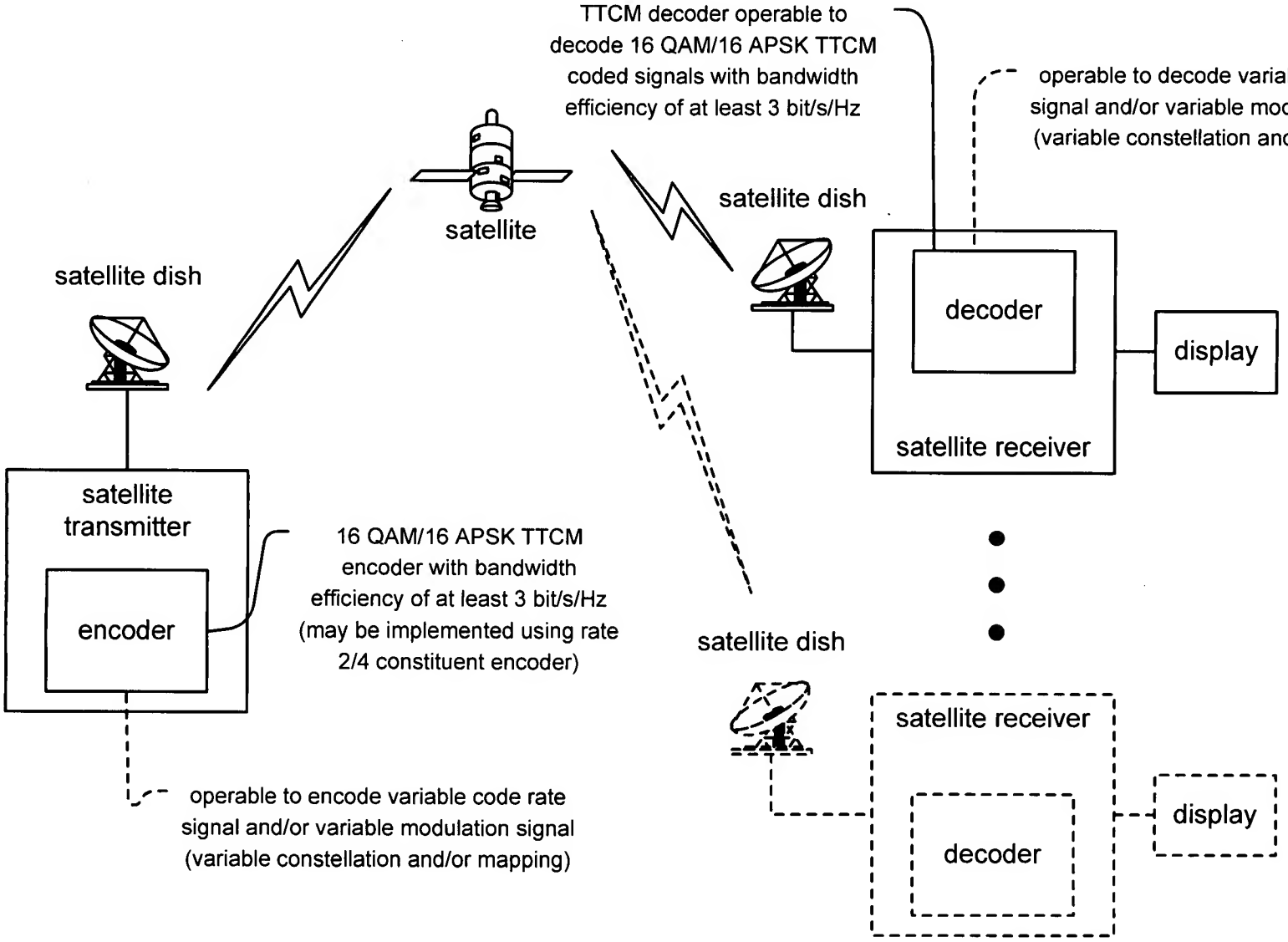
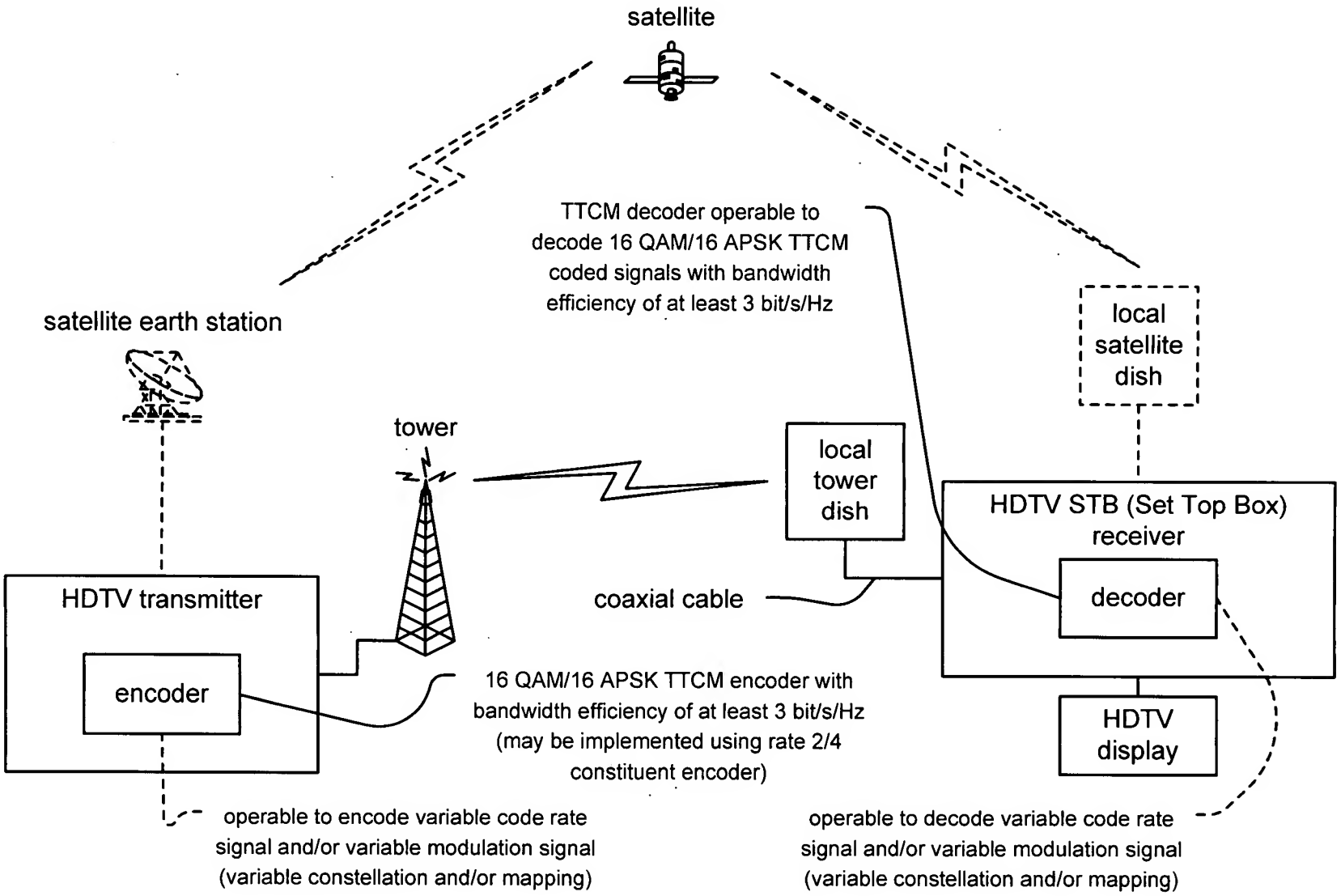


satellite communication system

Fig. 1



HDTV (High Definition Television) communication system

Fig. 2

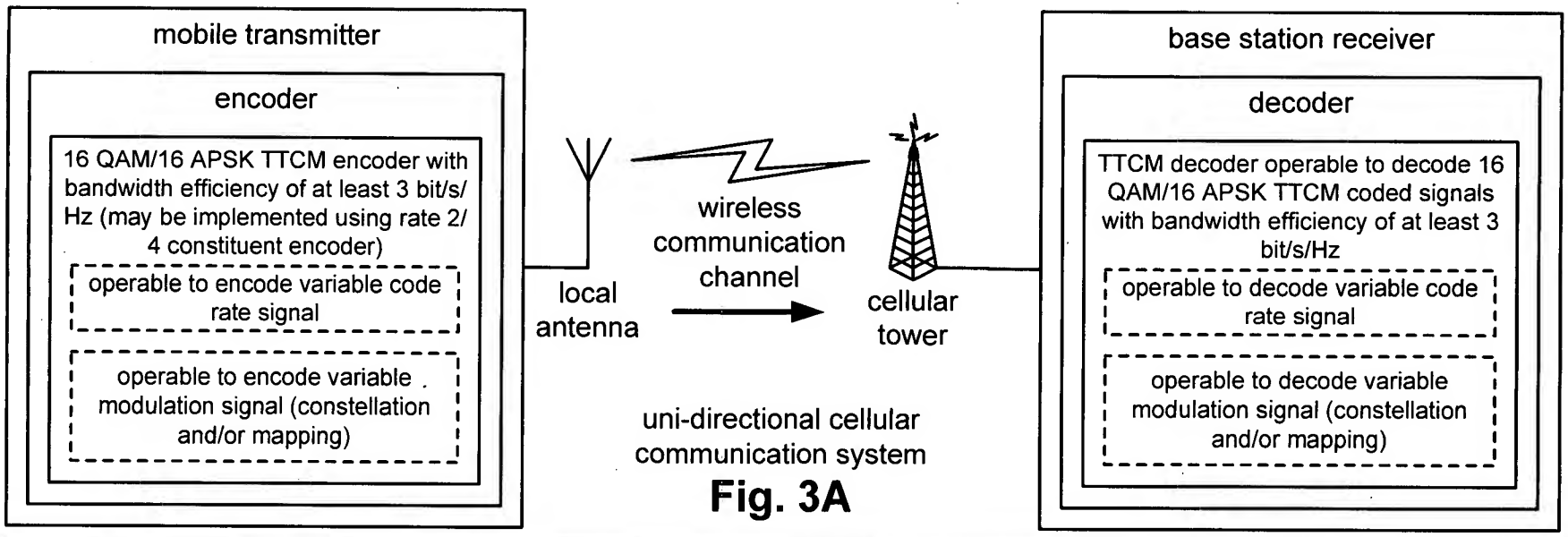

mobile transmitter
encoder
16 QAM/16 APSK TTCM encoder with bandwidth efficiency of at least 3 bit/s/Hz (may be implemented using rate 2/4 constituent encoder)
operable to encode variable code rate signal
operable to encode variable modulation signal (constellation and/or mapping)
local antenna
wireless communication channel
cellular tower
base station receiver
decoder
TTCM decoder operable to decode 16 QAM/16 APSK TTCM coded signals with bandwidth efficiency of at least 3 bit/s/Hz
operable to decode variable code rate signal
operable to decode variable modulation signal (constellation and/or mapping)
uni-directional cellular communication system

Fig. 3A

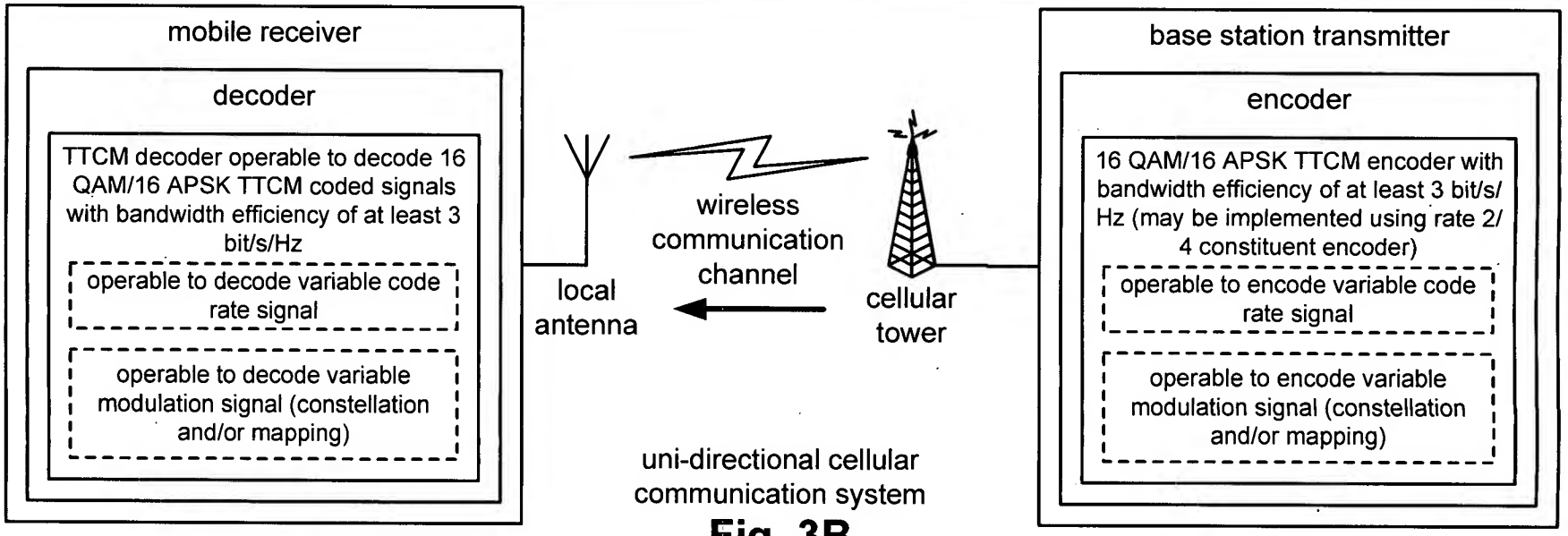
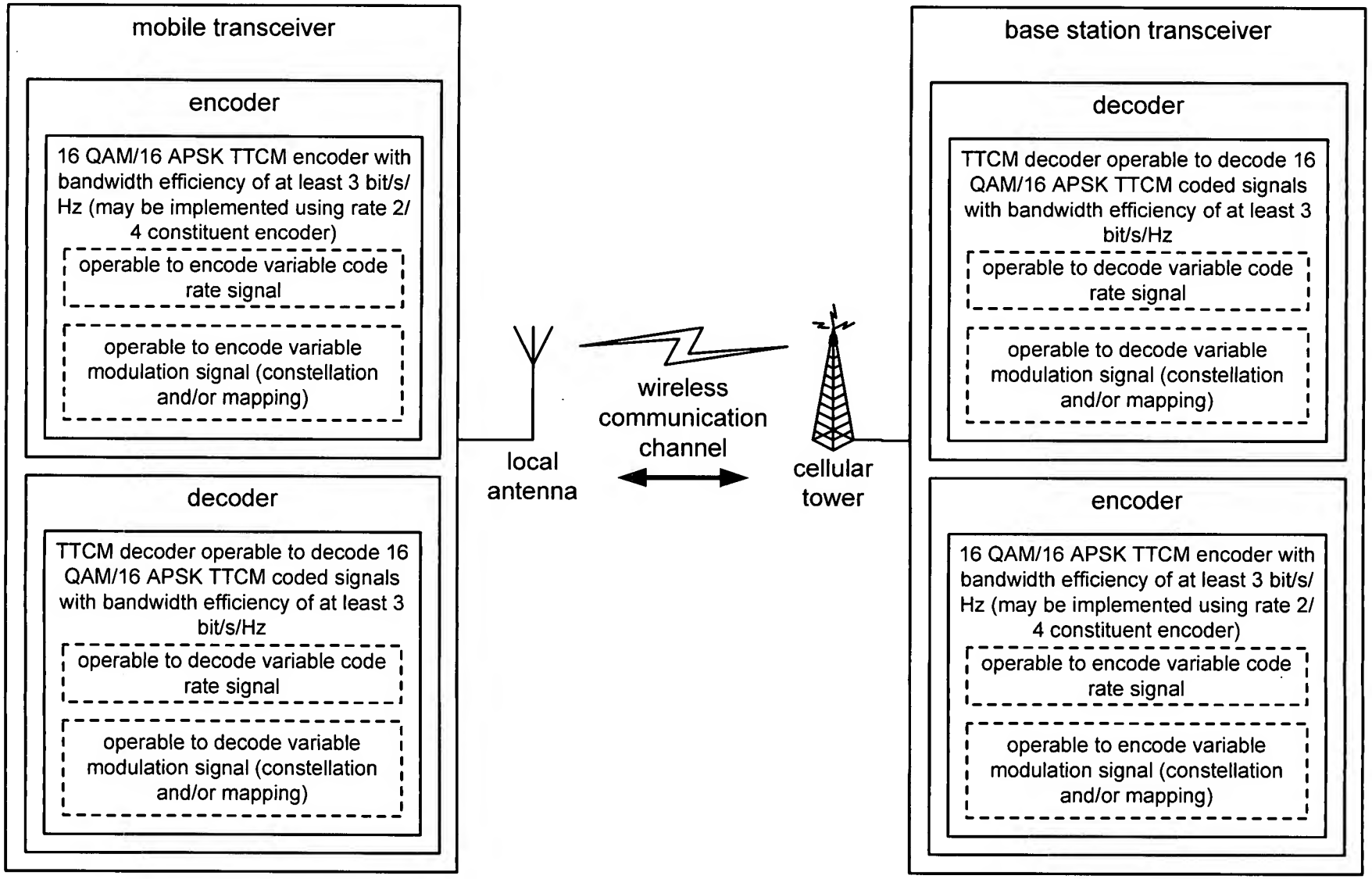
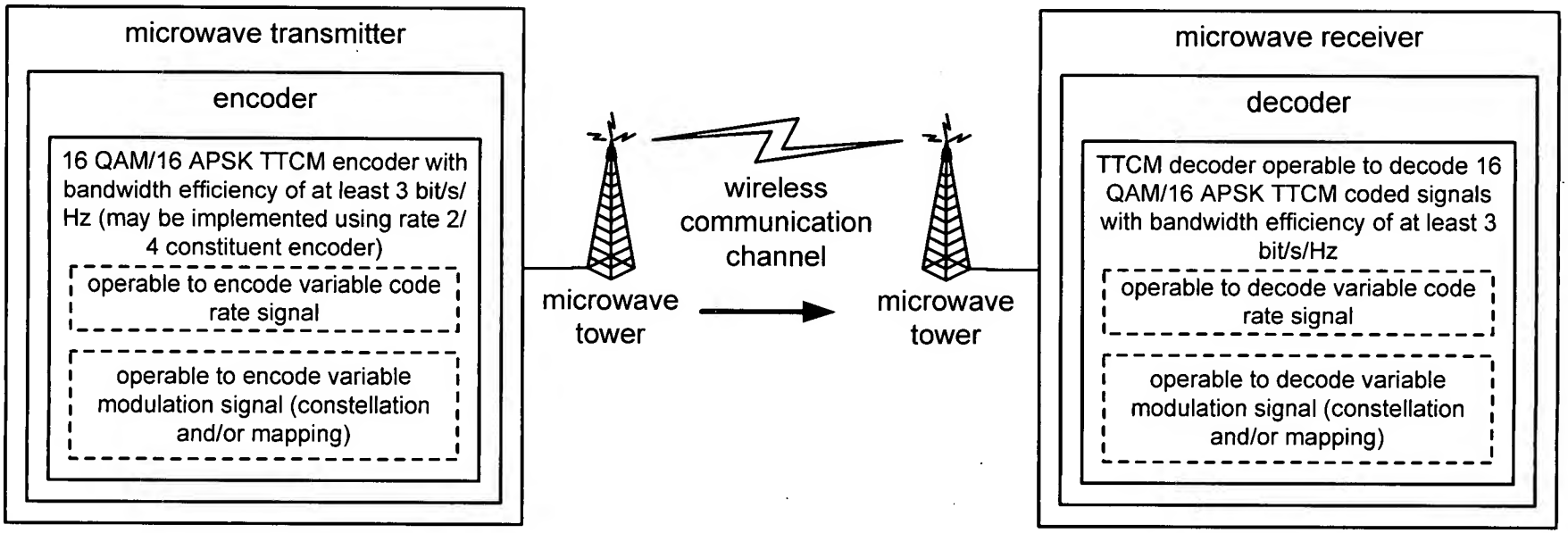

mobile receiver
decoder
TTCM decoder operable to decode 16 QAM/16 APSK TTCM coded signals with bandwidth efficiency of at least 3 bit/s/Hz
operable to decode variable code rate signal
operable to decode variable modulation signal (constellation and/or mapping)
local antenna
wireless communication channel
cellular tower
base station transmitter
encoder
16 QAM/16 APSK TTCM encoder with bandwidth efficiency of at least 3 bit/s/Hz (may be implemented using rate 2/4 constituent encoder)
operable to encode variable code rate signal
operable to encode variable modulation signal (constellation and/or mapping)
uni-directional cellular communication system

Fig. 3B



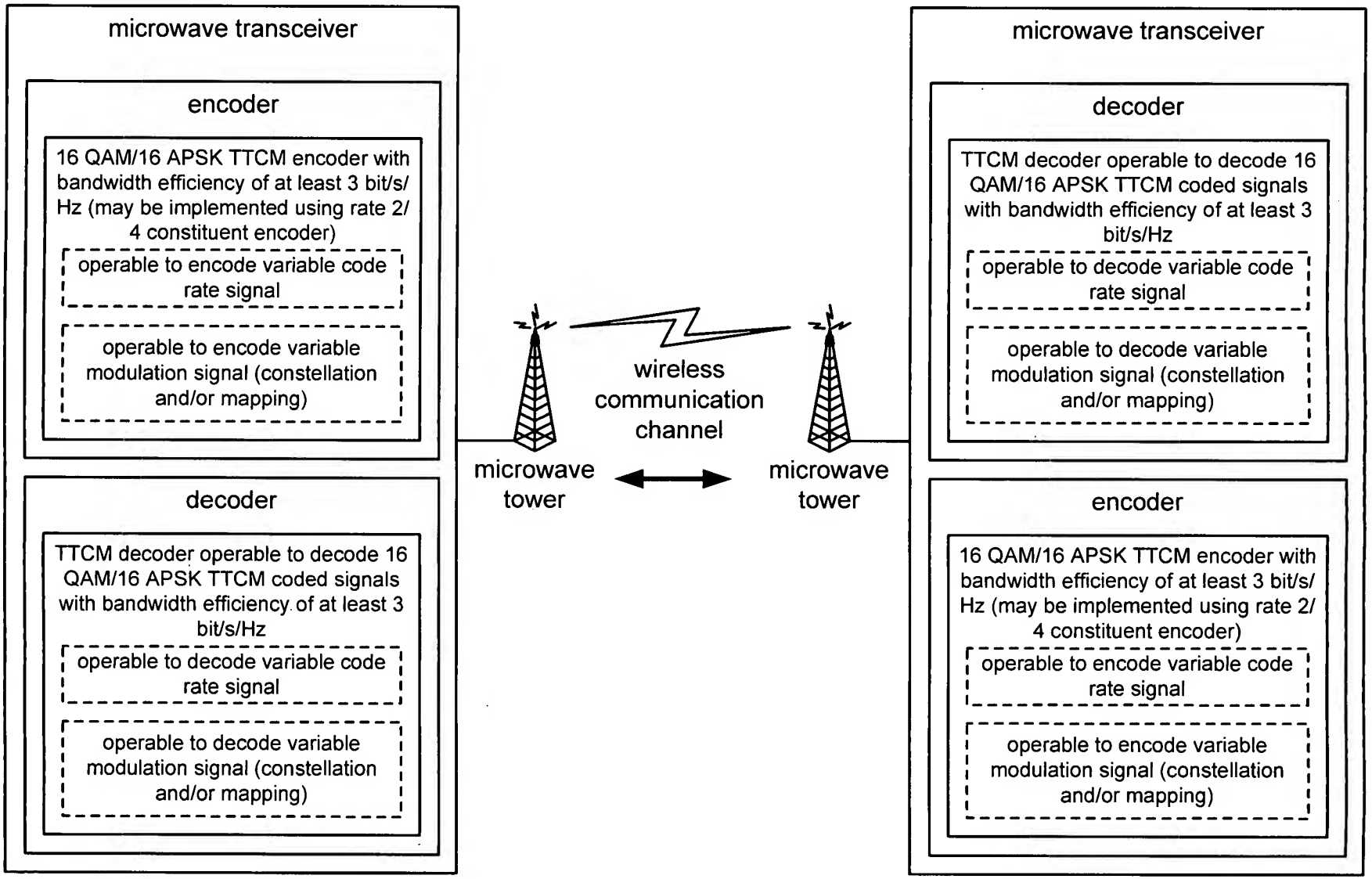
bi-directional cellular communication system

Fig. 4



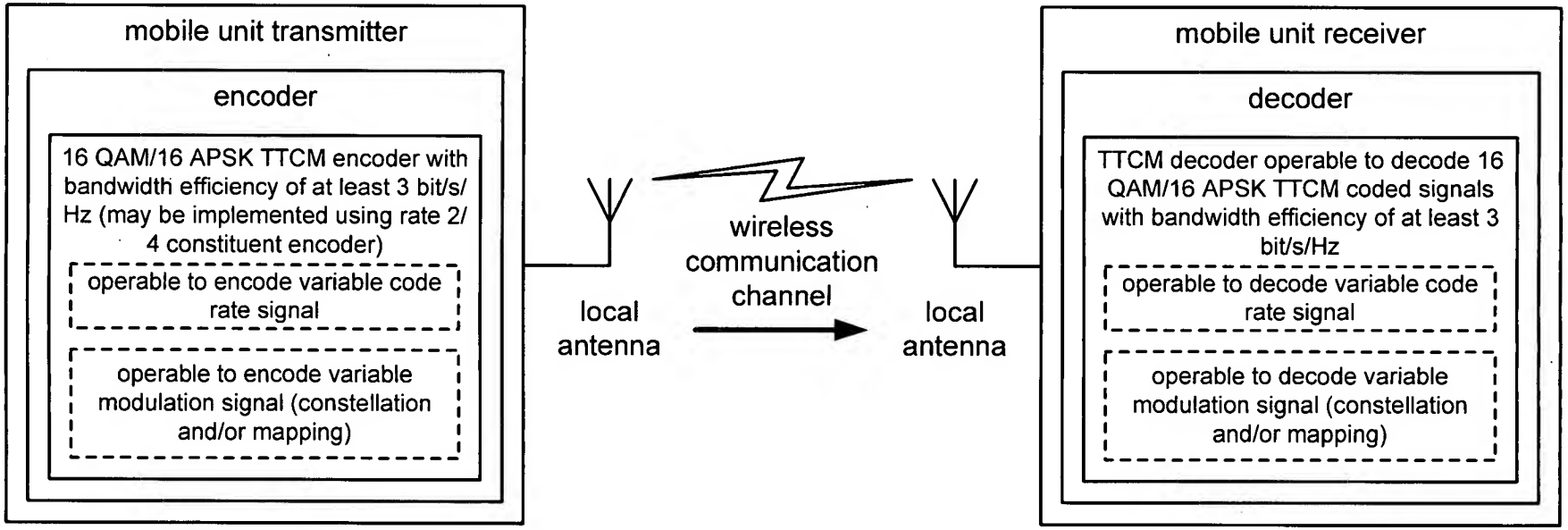
uni-directional microwave communication system

Fig. 5



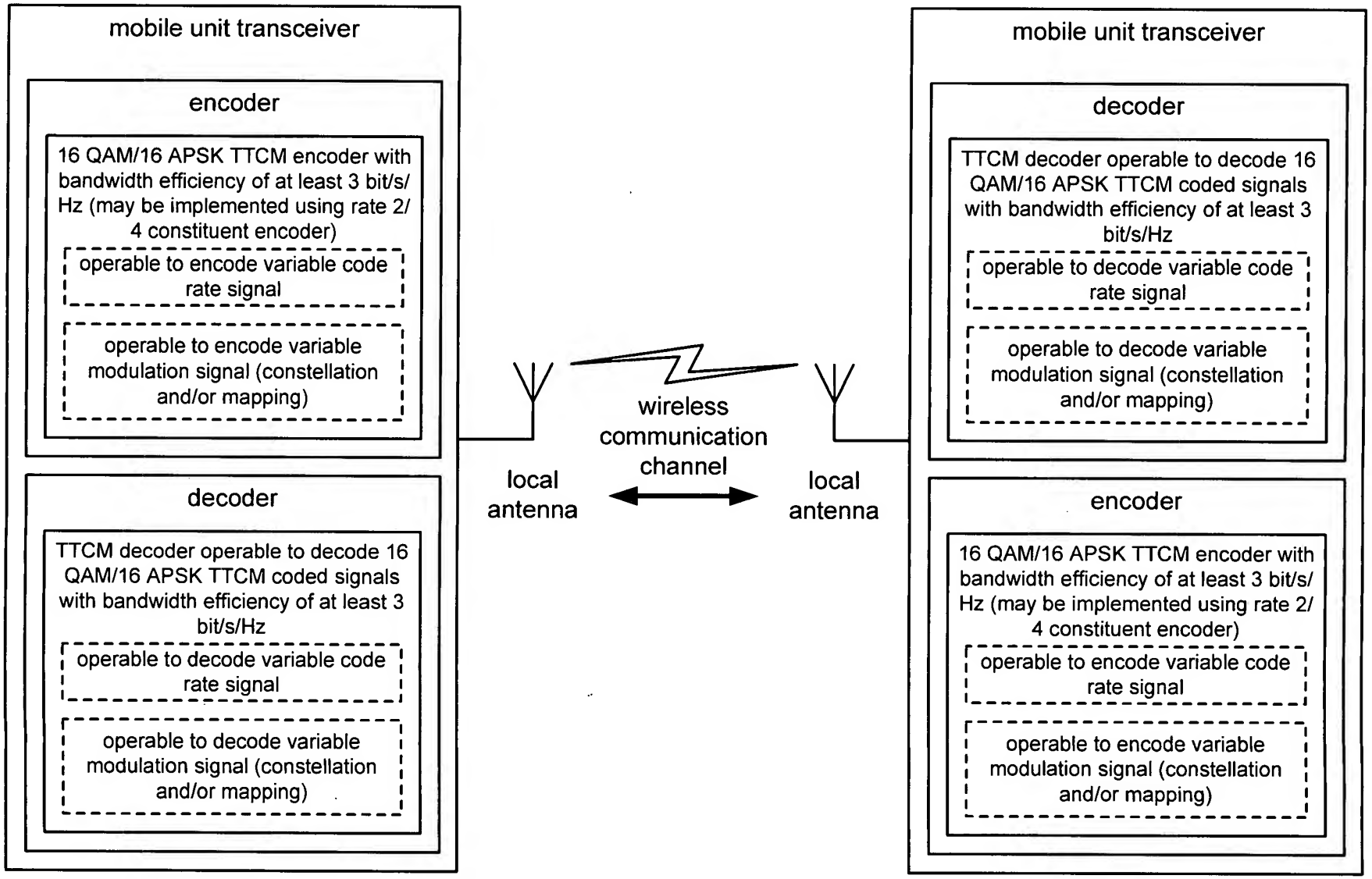
bi-directional microwave communication system

Fig. 6



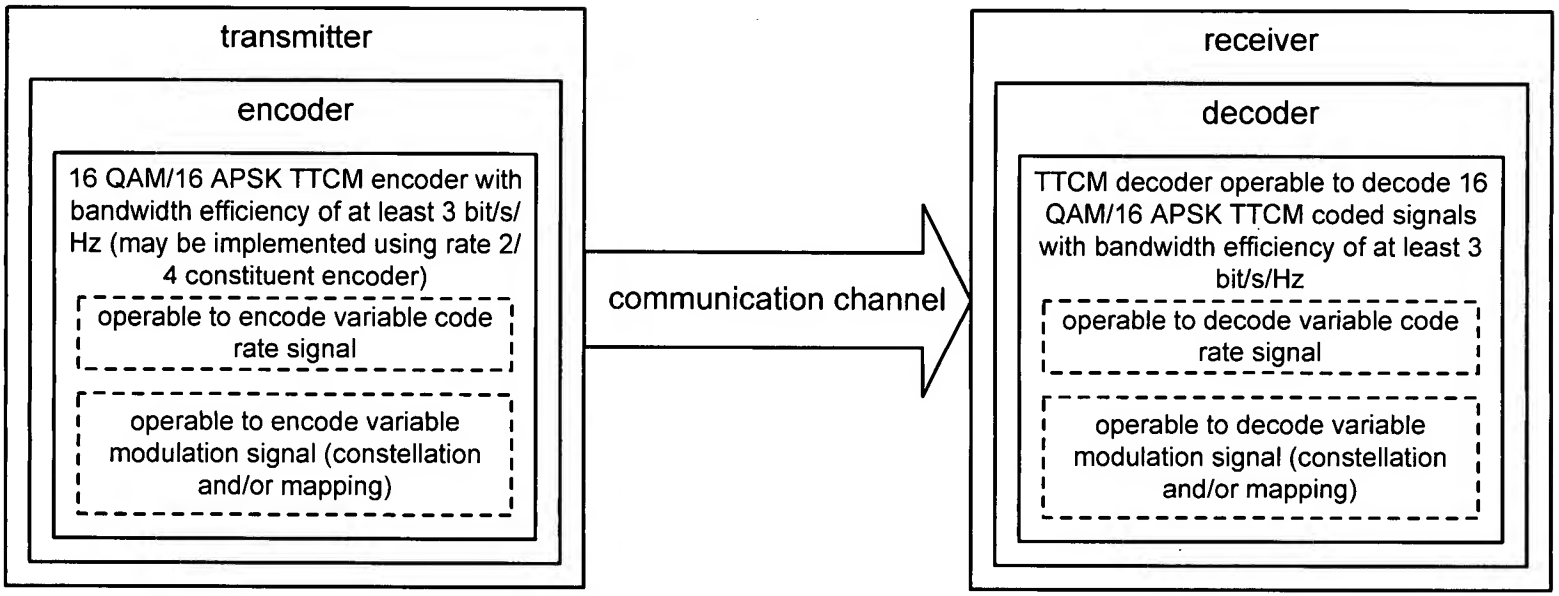
uni-directional point-to-point radio communication system

Fig. 7



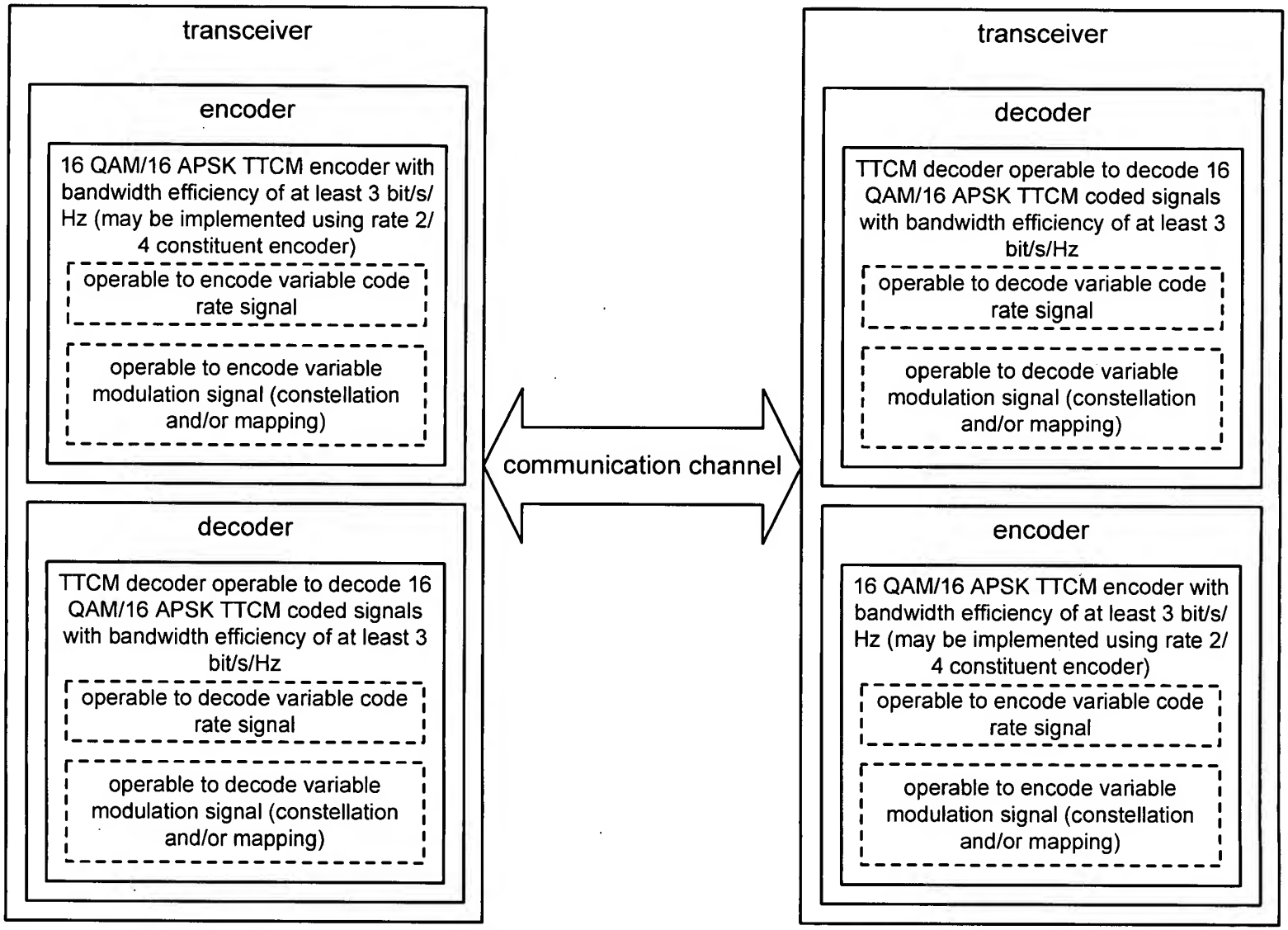
bi-directional point-to-point radio communication system

Fig. 8



uni-directional communication system

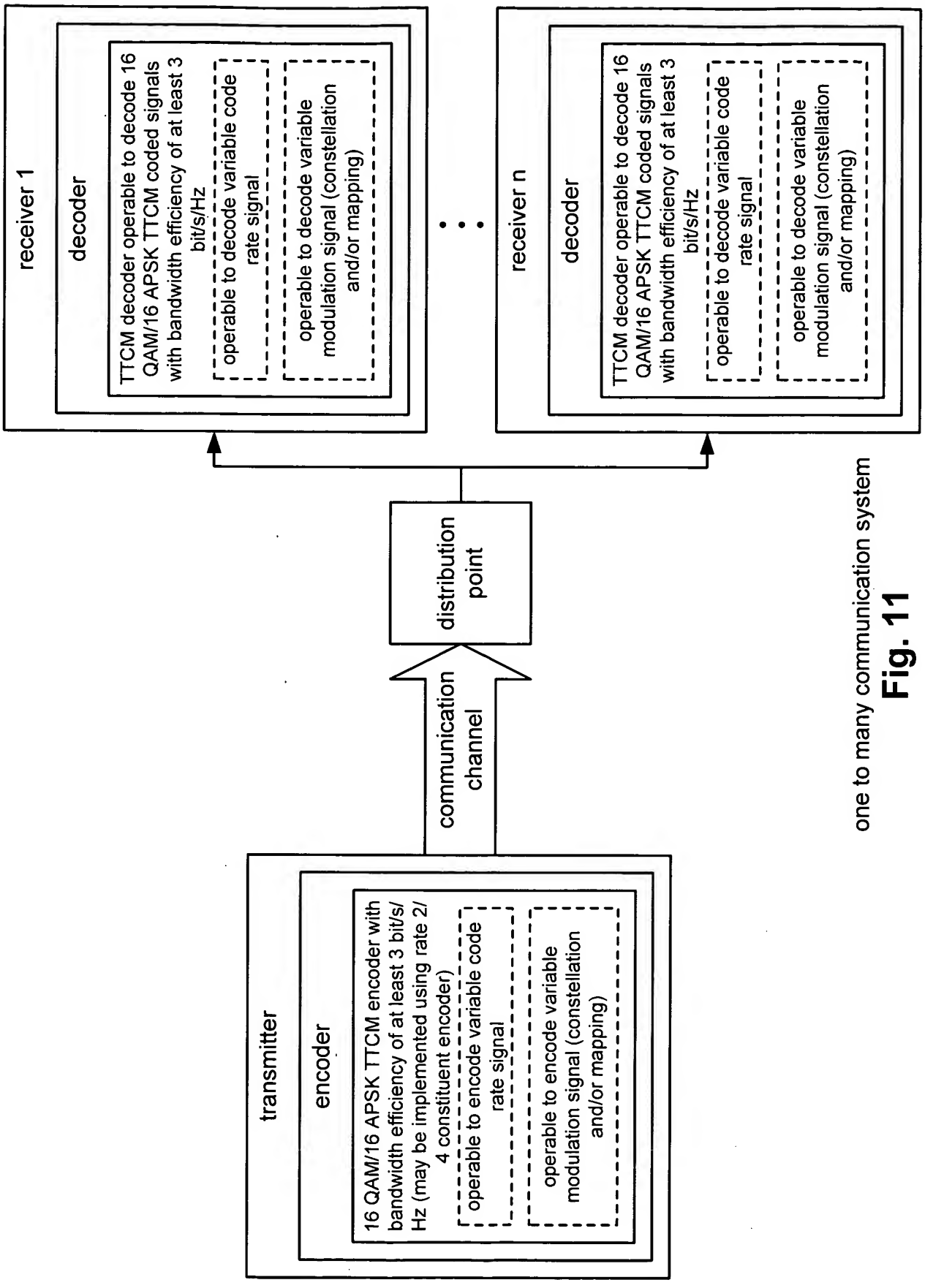
Fig. 9



bi-directional communication system

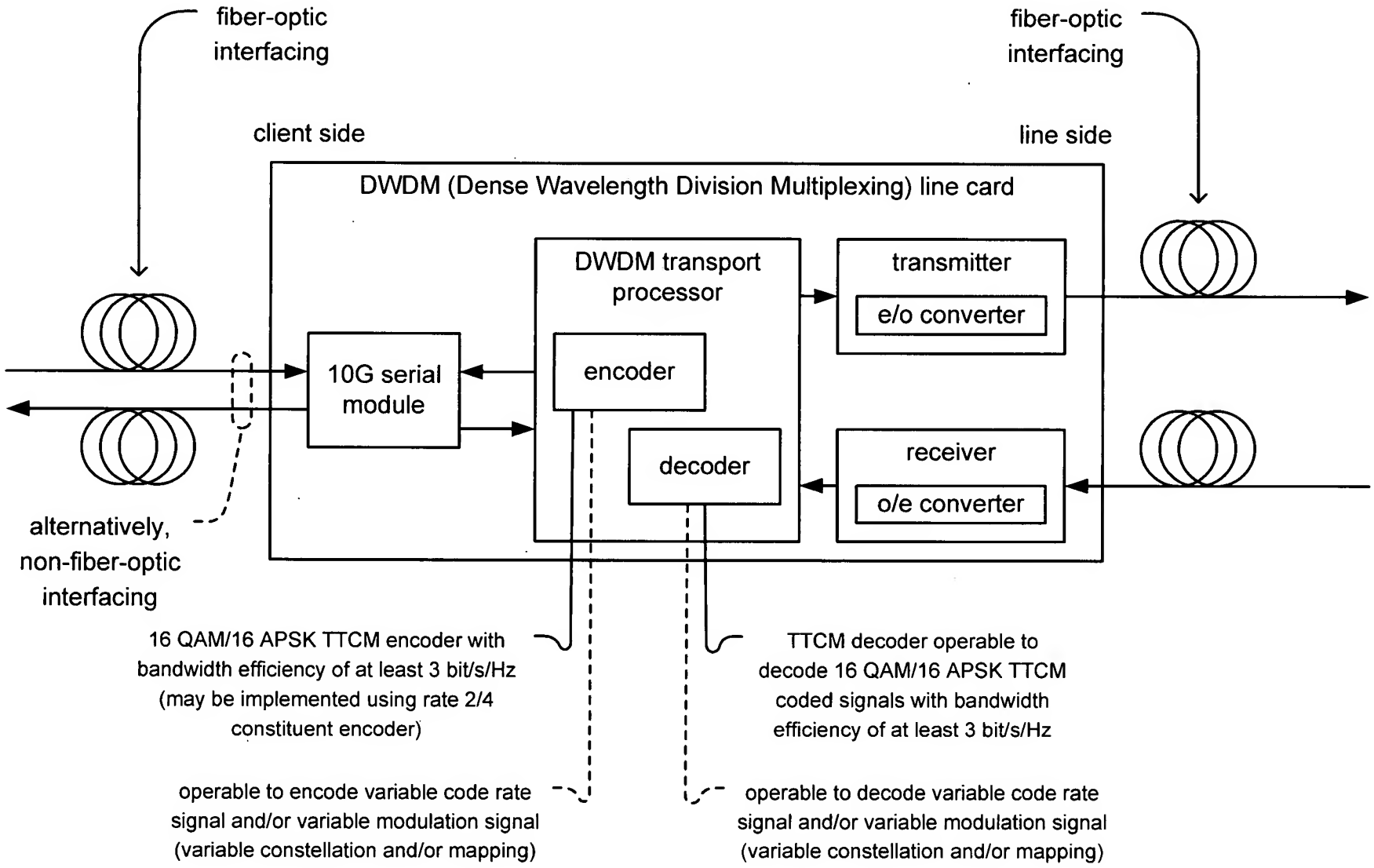
Fig. 10

BP3018: Replacement Sheet



one to many communication system

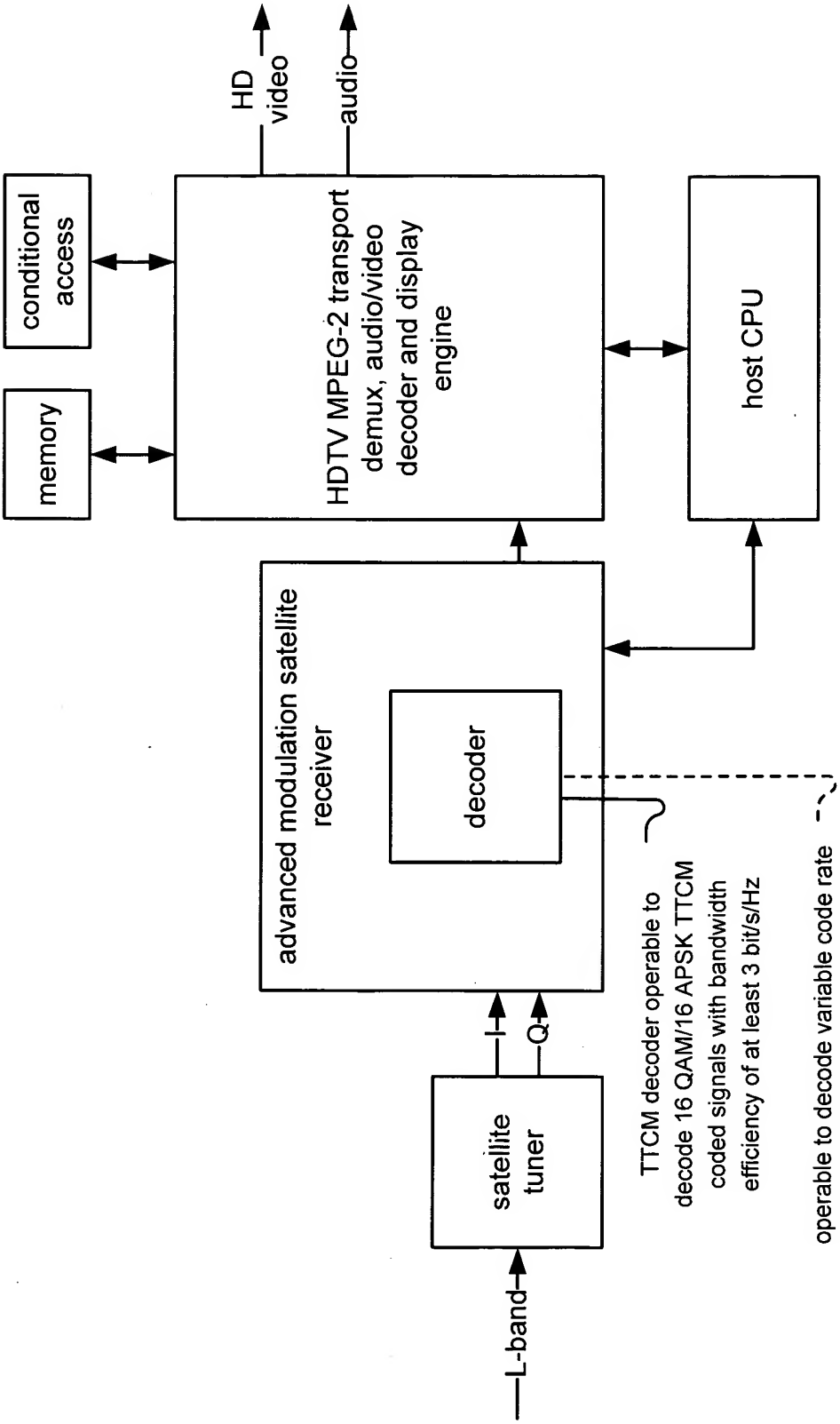
Fig. 11



fiber-optic communication system

Fig. 12

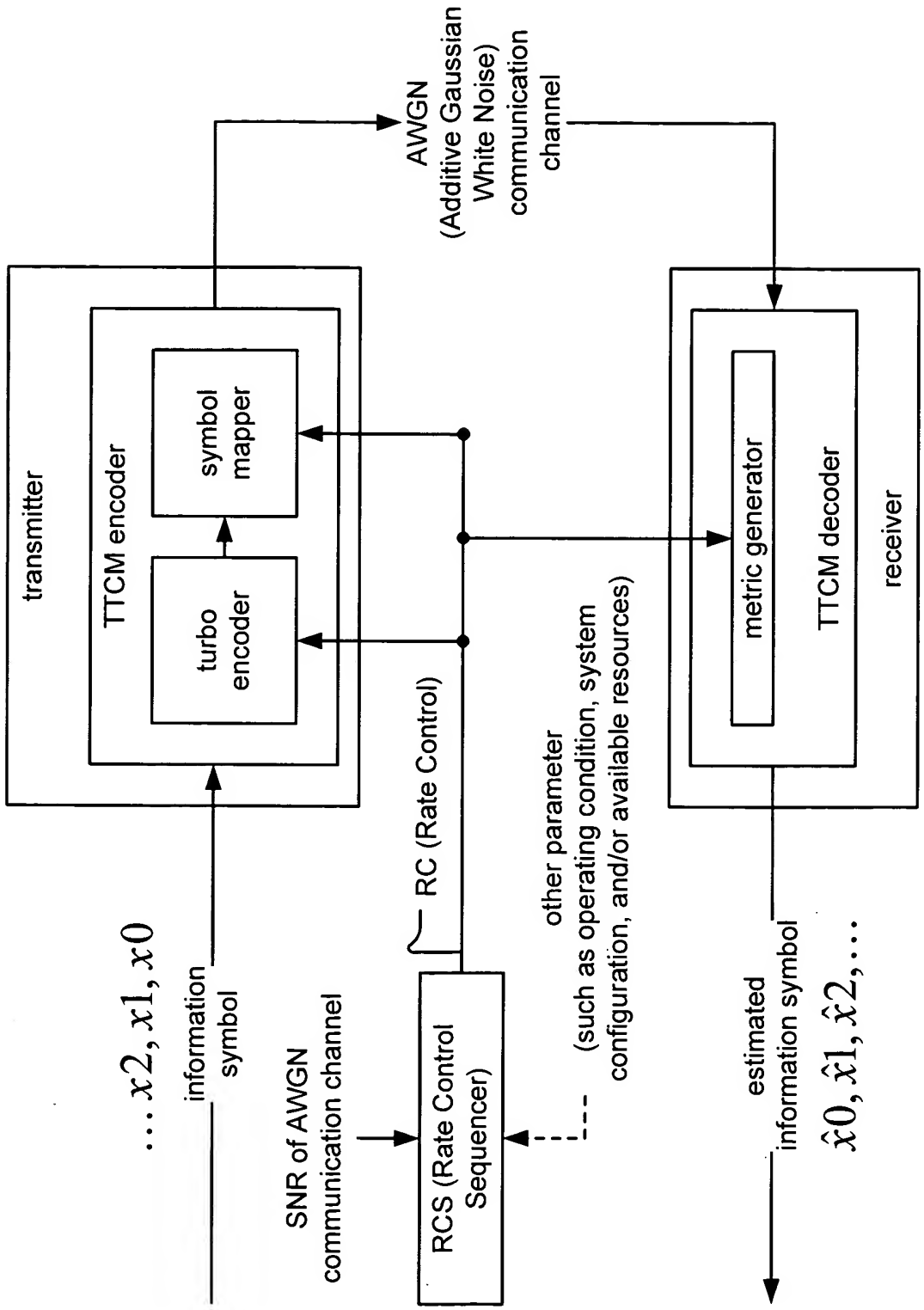
BP3018: Replacement Sheet



satellite receiver STB (Set Top Box) system

Fig. 13

BP3018: Replacement Sheet



TTCM (Turbo Trellis Coded Modulation) communication system

Fig. 14

BP3018: Replacement Sheet

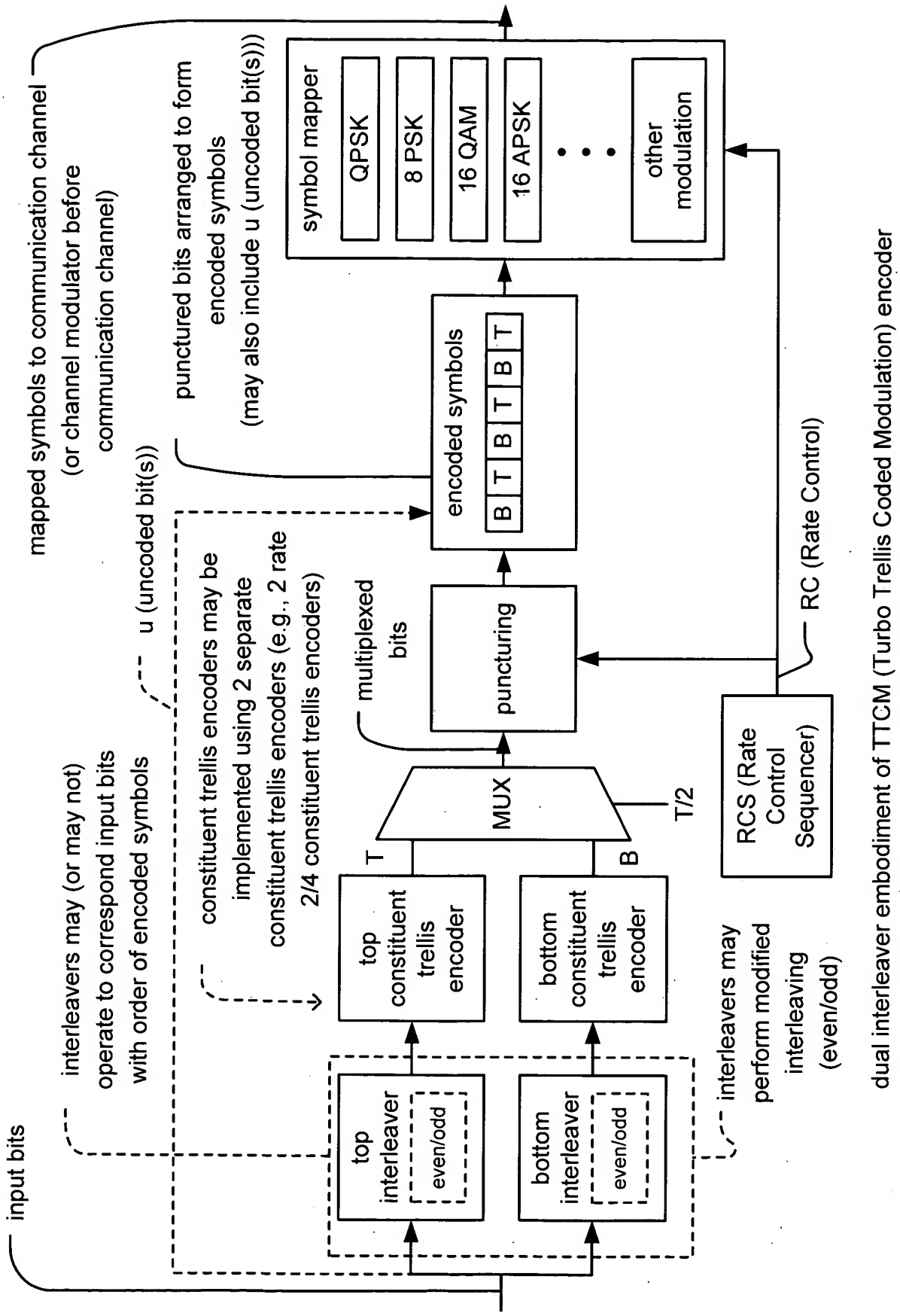


Fig. 15

dual interleaver embodiment of TTCM (Turbo Trellis Coded Modulation) encoder

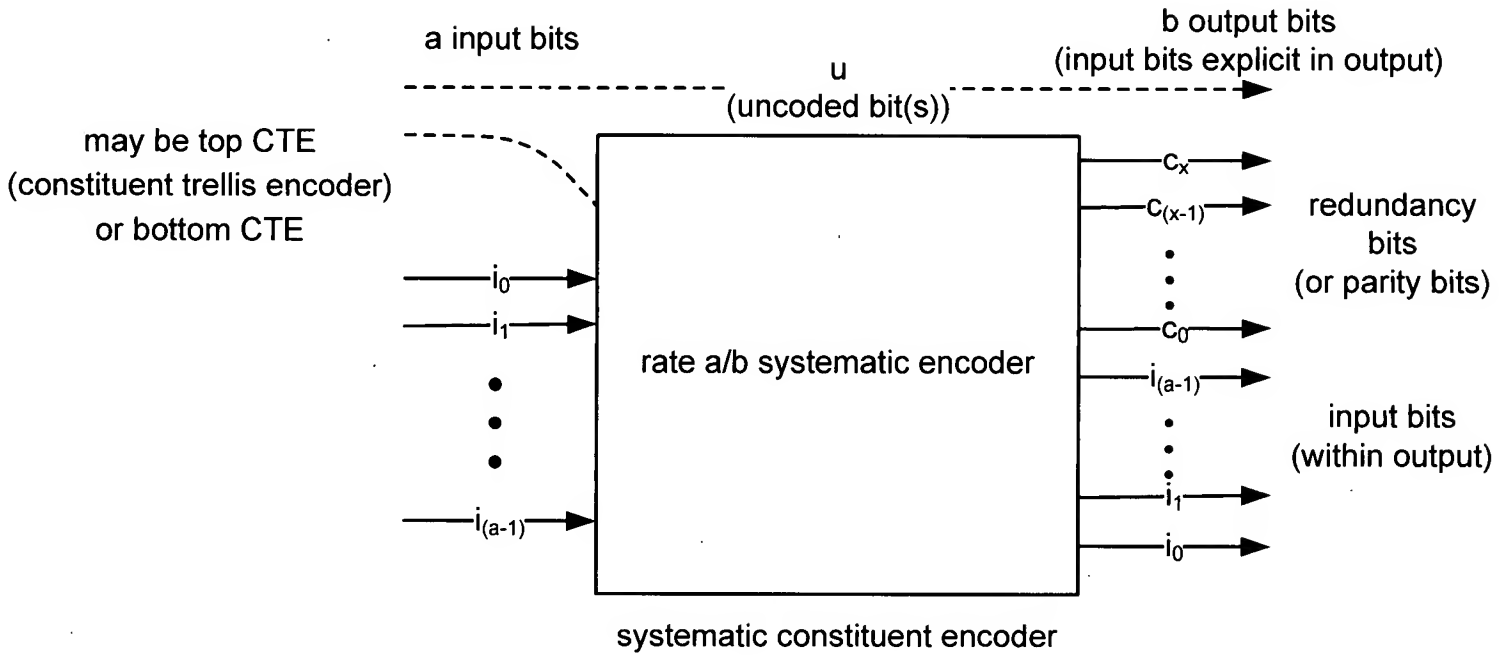
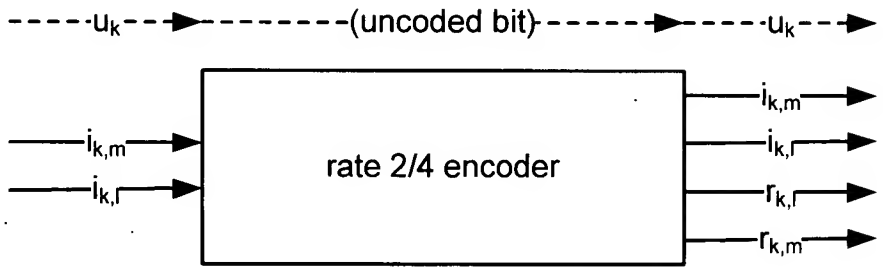
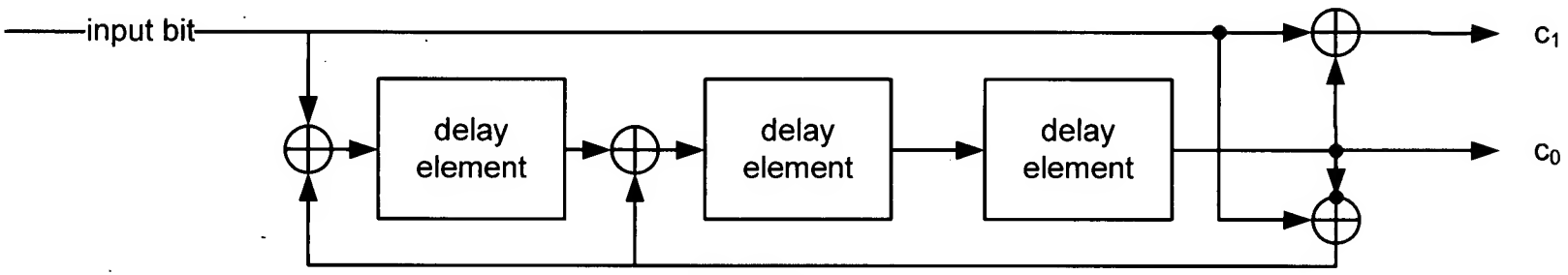


Fig. 16A



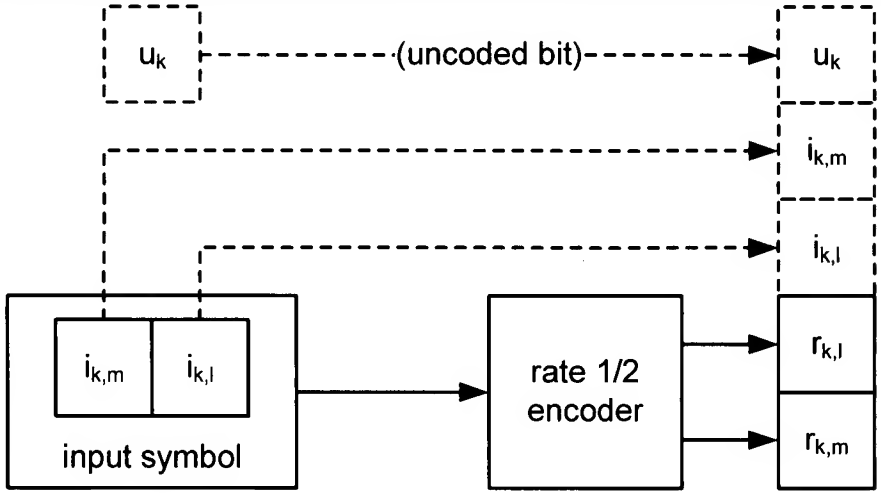
rate 2/4 constituent encoder

Fig. 16B



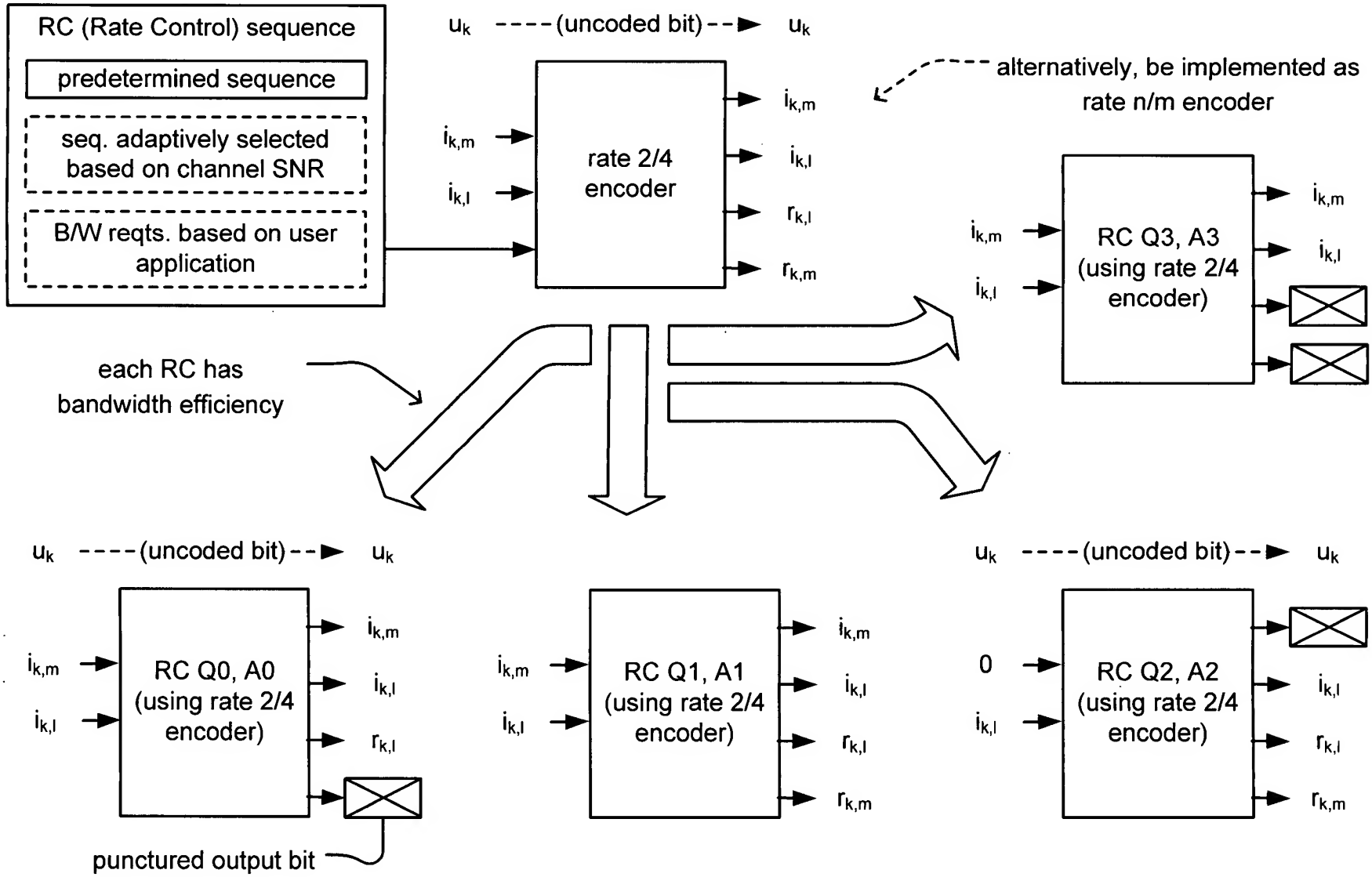
rate 1/2 recursive convolutional encoder with non-systematic output

Fig. 17A



rate 2/4 prototype encoder

Fig. 17B



rate 2/4 prototype encoder supporting multiple encoders

Fig. 18

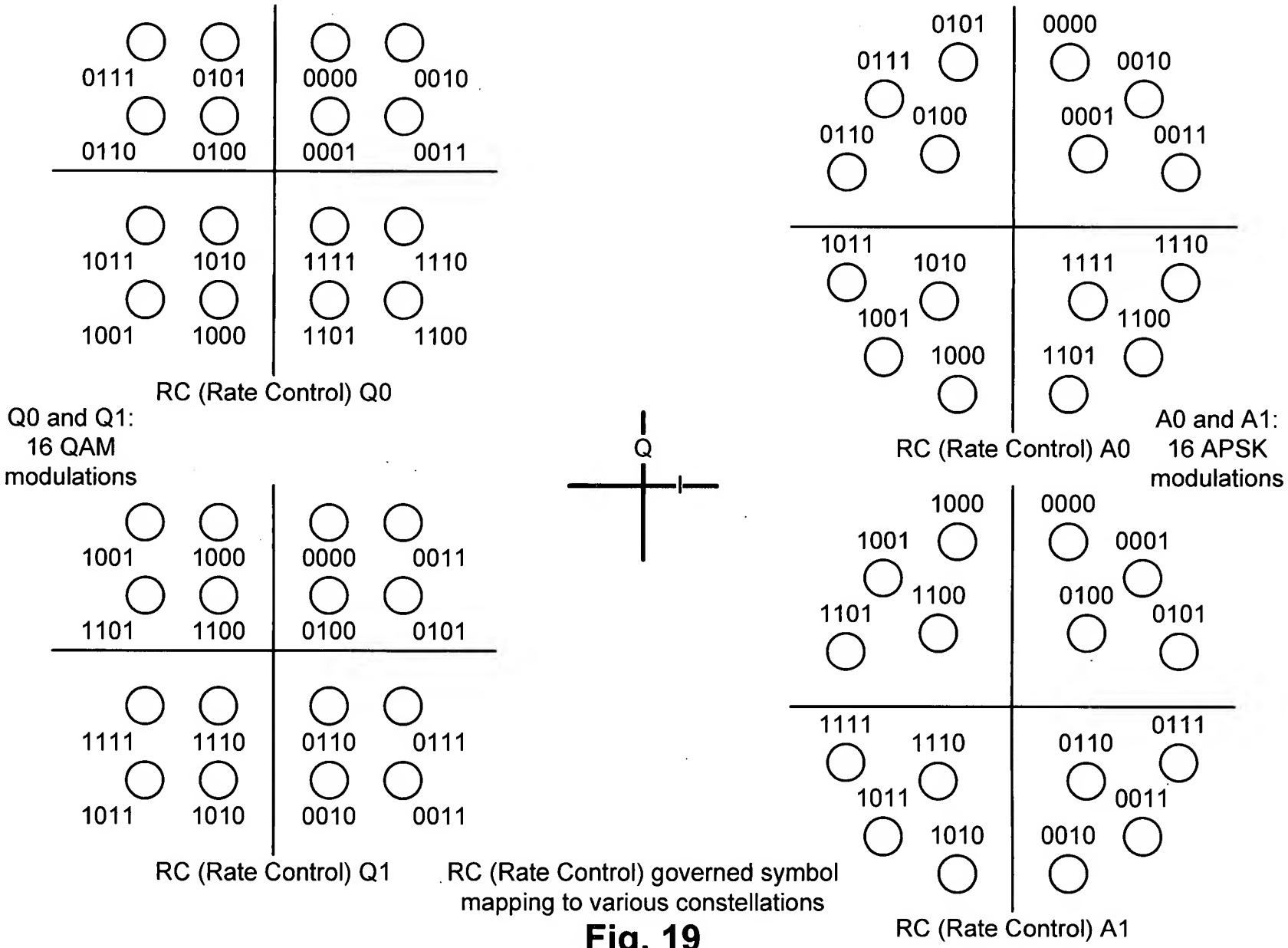
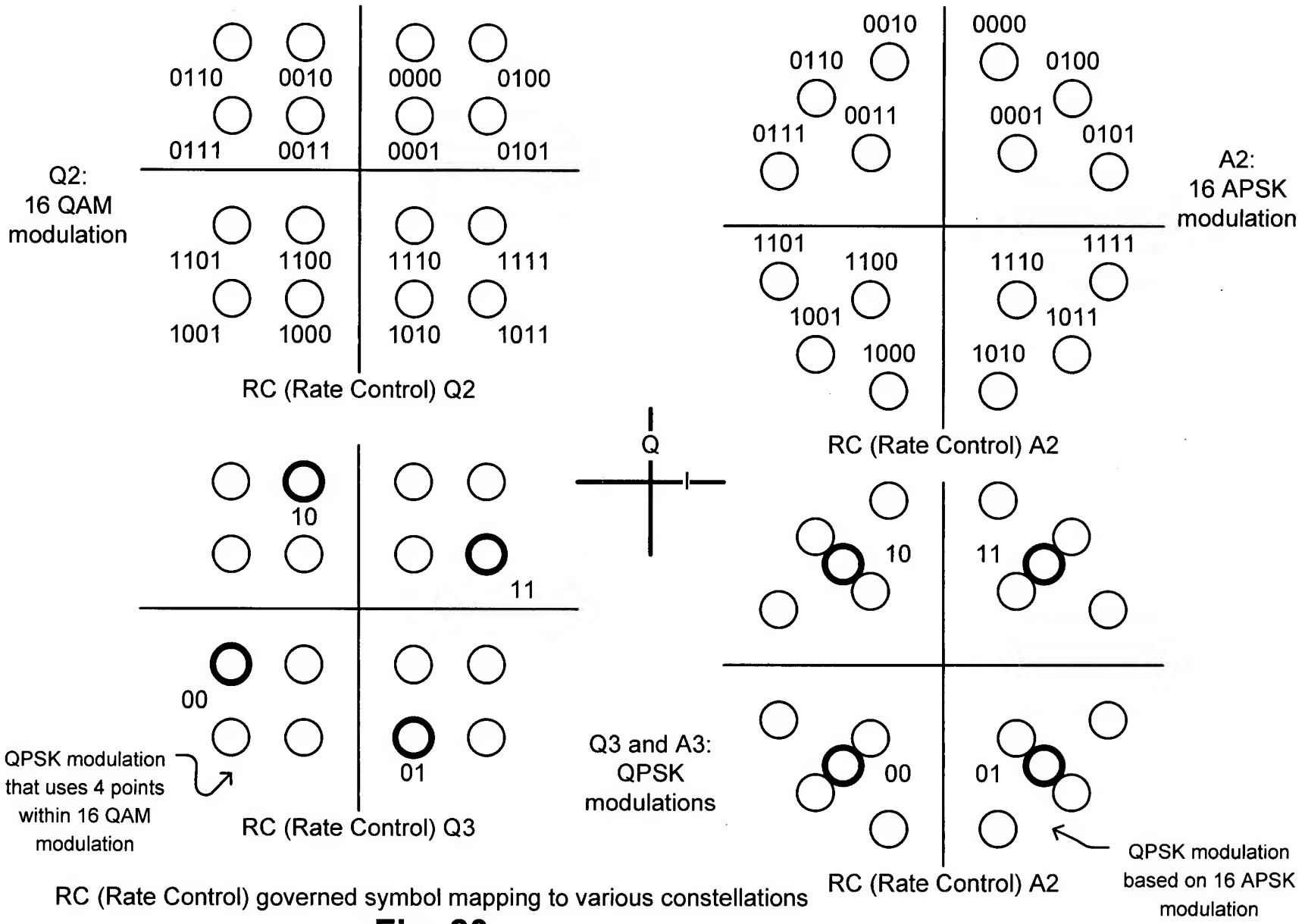
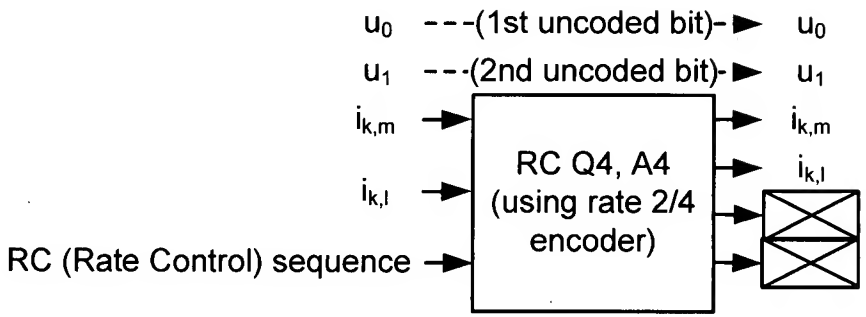

0111 0101 0000 0010
0110 0100 0001 0011
1011 1010 1111 1110
1001 1000 1101 1100
RC (Rate Control) Q0
Q0 and Q1:
16 QAM
modulations
Q
1001 1000 0000 0011
1101 1100 0100 0101
1111 1110 0110 0111
1011 1010 0010 0011
RC (Rate Control) Q1
RC (Rate Control) governed symbol
mapping to various constellations
0101 0000
0111 0010
0110 0100 0001 0011
1011 1010 1111 1110
1001 1000 1101 1100
RC (Rate Control) A0
A0 and A1:
16 APSK
modulations
1000 0000
1001 0001
1100 0100 0101
1101
1111 0111
1110 0110
1011 0011
1010 0010
RC (Rate Control) A1

Fig. 19



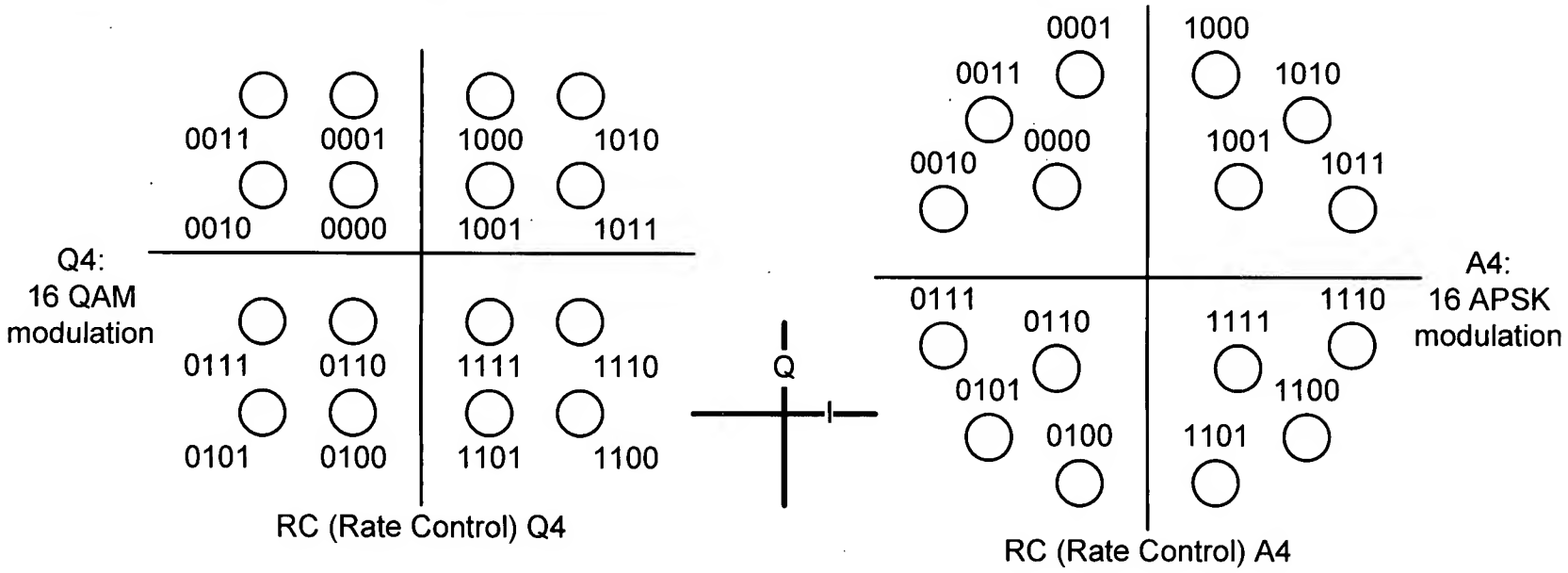
RC (Rate Control) governed symbol mapping to various constellations

Fig. 20



rate 2/4 prototype encoder supporting RCs Q4, A4 (each having 2 uncoded bits)

Fig. 21A



RC (Rate Control) governed symbol mapping to various constellations

Fig. 21B

bandwidth efficiency	a period of a sequence for 16 QAM	a period of a sequence for 16 APSK
3.33 bit/s/Hz	Q0 Q0 Q4	A0 A0 A4
3.5 bit/s/Hz	Q0 Q0 Q4 Q4	A0 A0 A4 A4

periodic RC (Rate Control) sequences of TTCM supporting bandwidth efficiencies of at least 3 bit/s/Hz

Fig. 22A

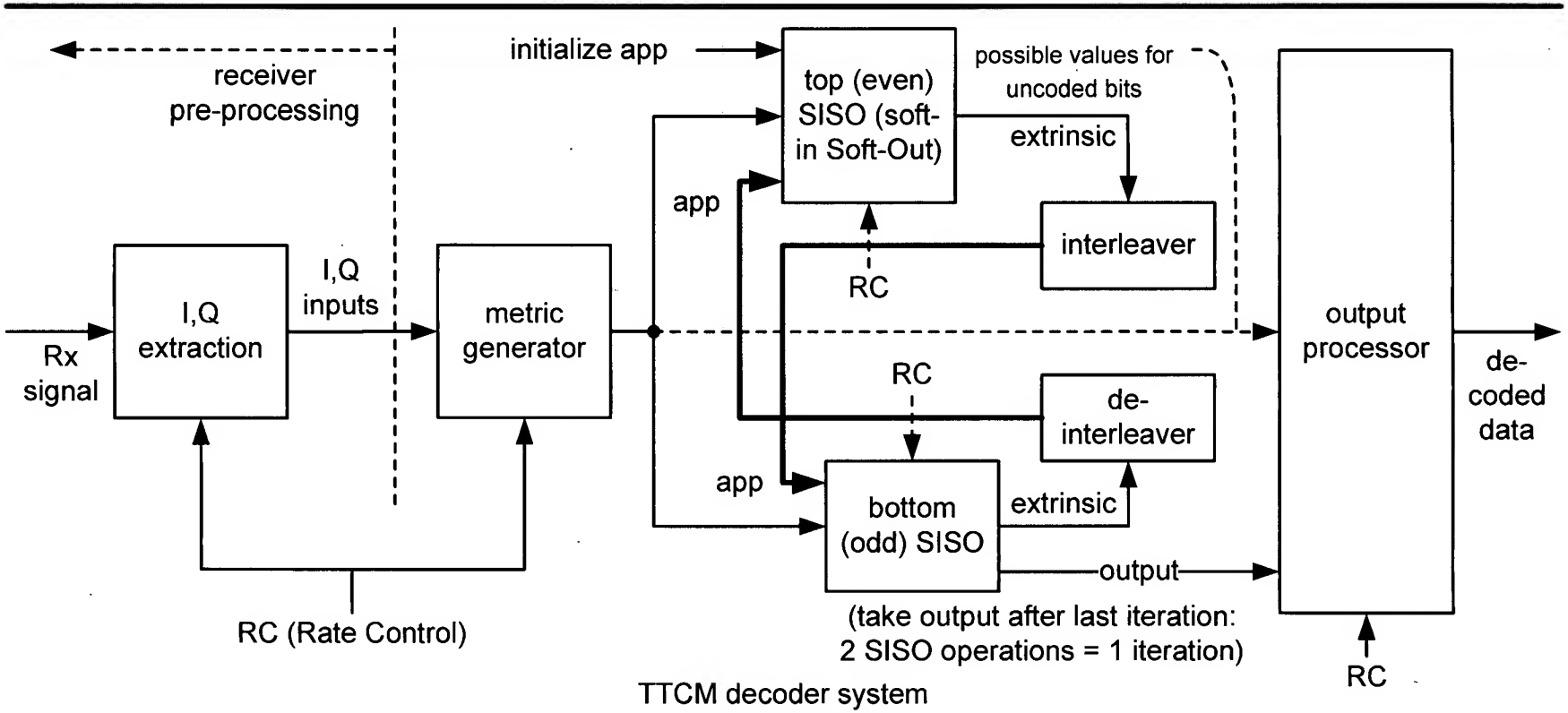
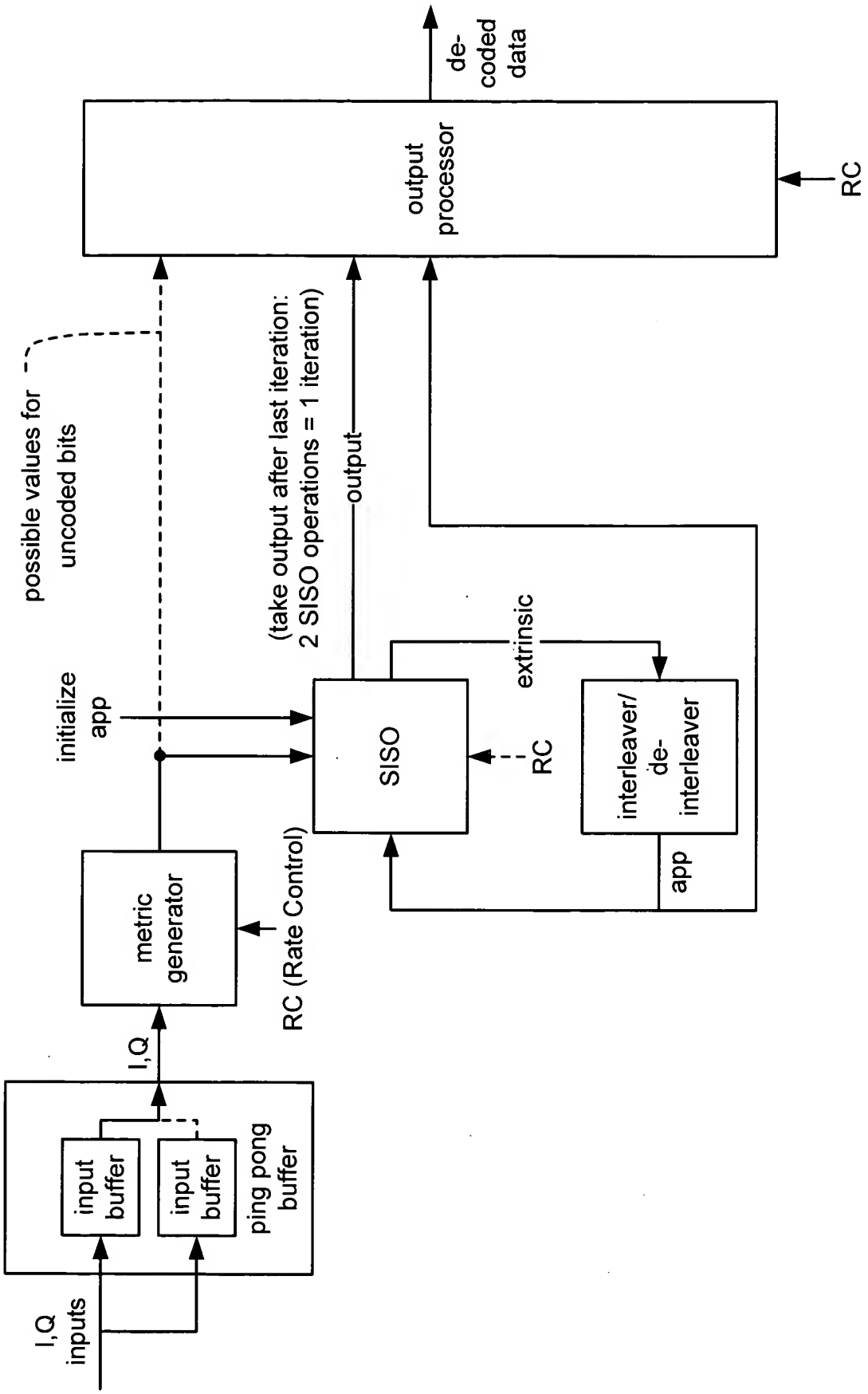


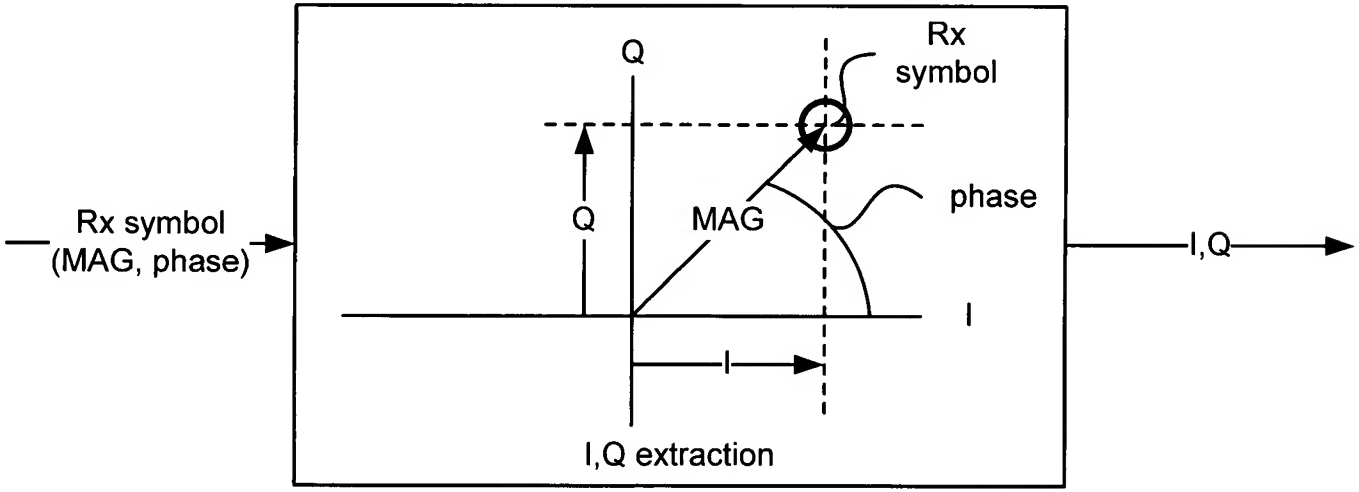
Fig. 22B

BP3018: Replacement Sheet



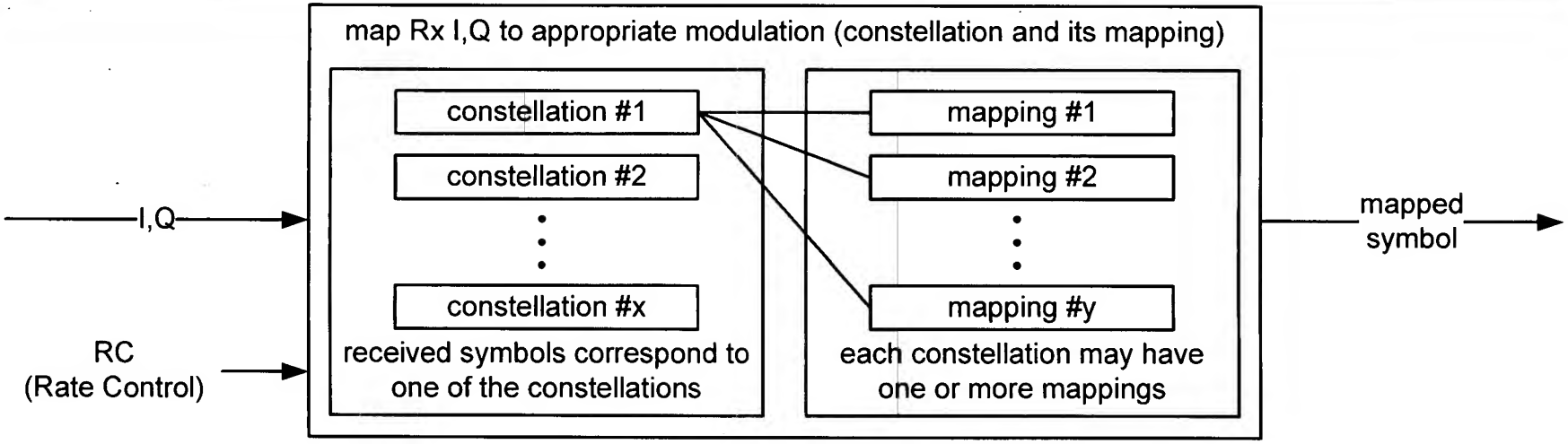
alternative TTCM decoder system that recycles single SISO (receiving I,Q inputs)

Fig. 23



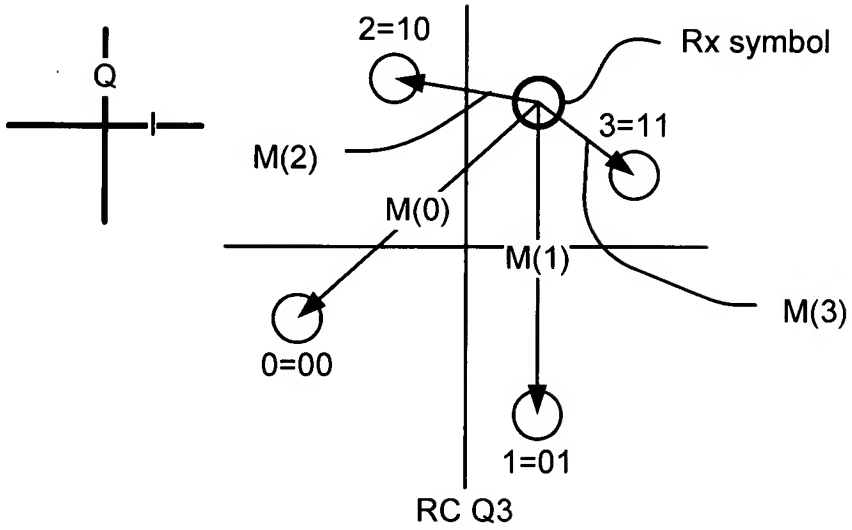
I,Q (In-phase, Quadrature) extraction

Fig. 24A



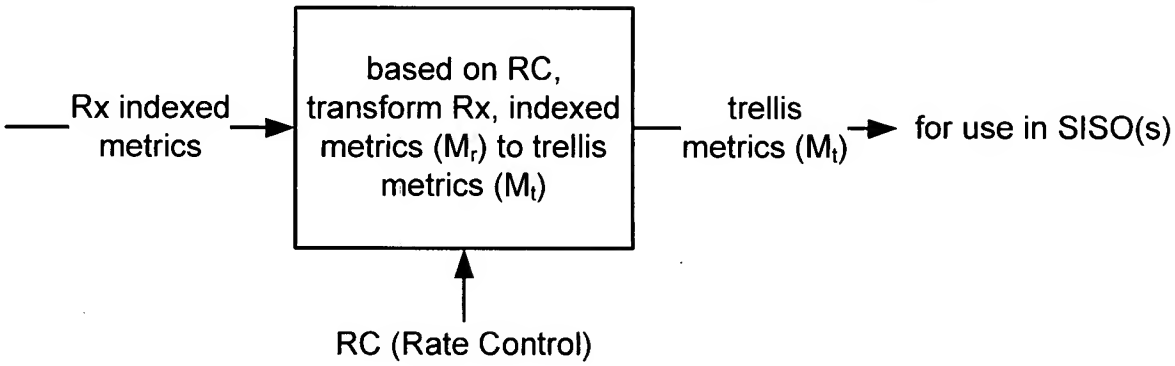
Rx I,Q mapping based on RC

Fig. 24B



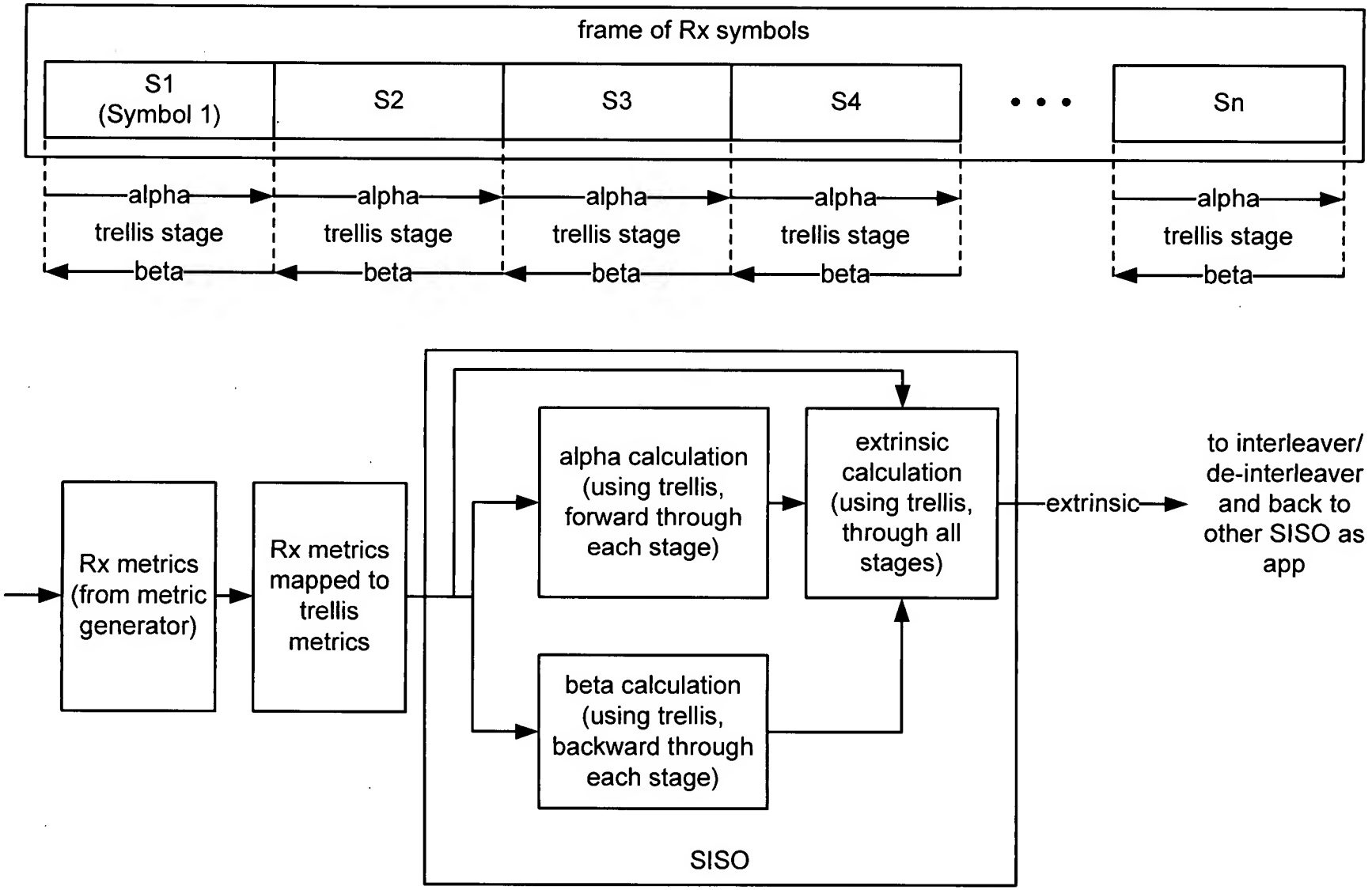
metric calculation performed by metric generator (shown for RC Q3 embodiment)

Fig. 25A



metric mapping functionality

Fig. 25B



SISO calculations and operations

Fig. 26

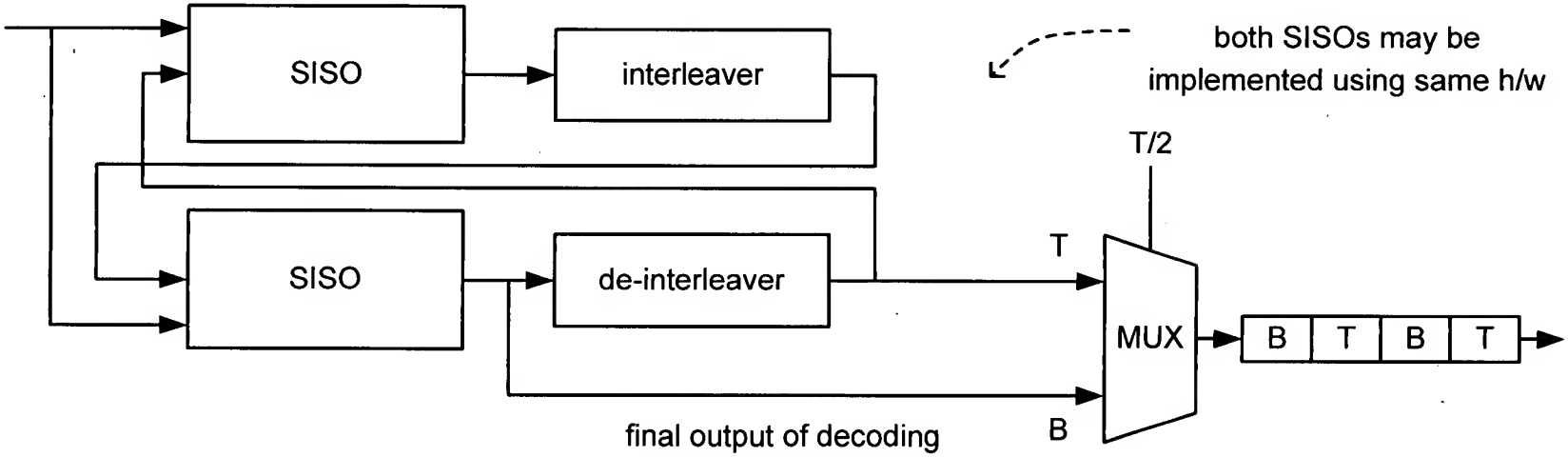
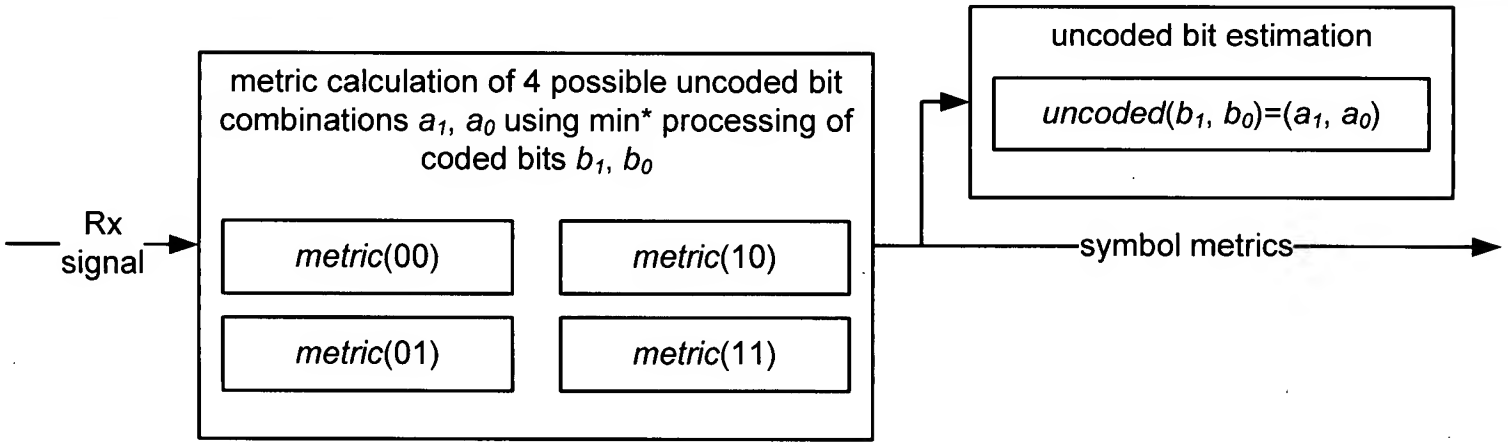
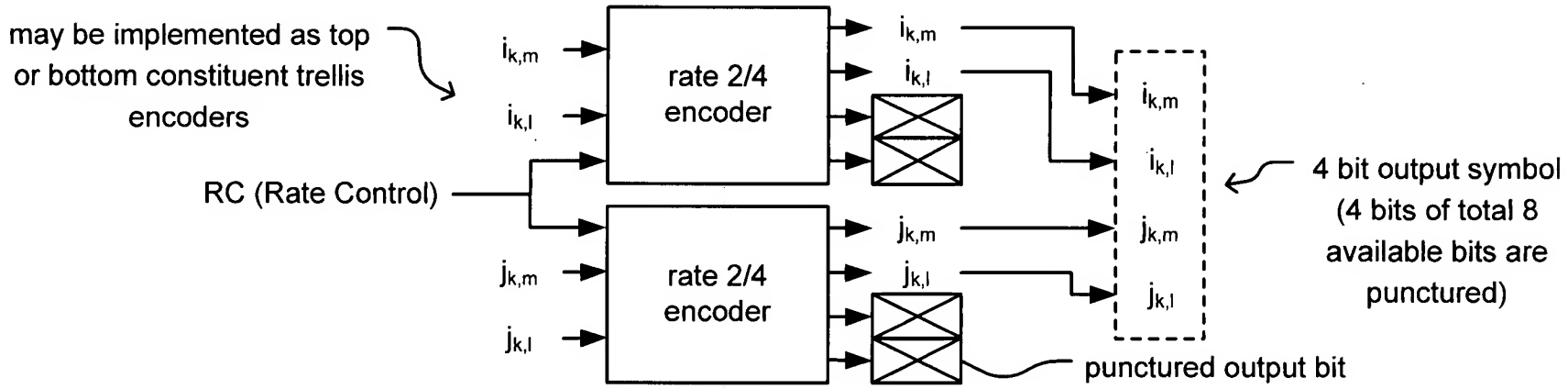


Fig. 27A



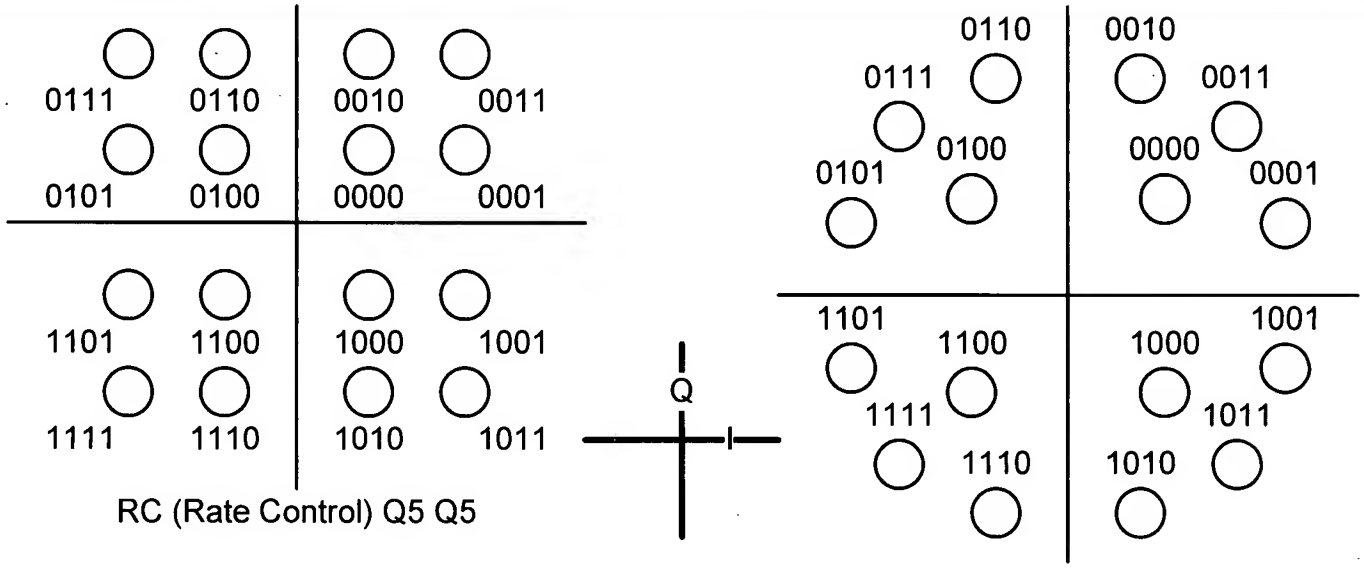
metric generator computation to accommodate RCs Q4 and A4

Fig. 27B



dual rate 2/4 prototype encoders supporting RCs (Q5 Q5) or (A5 A5)

Fig. 28A



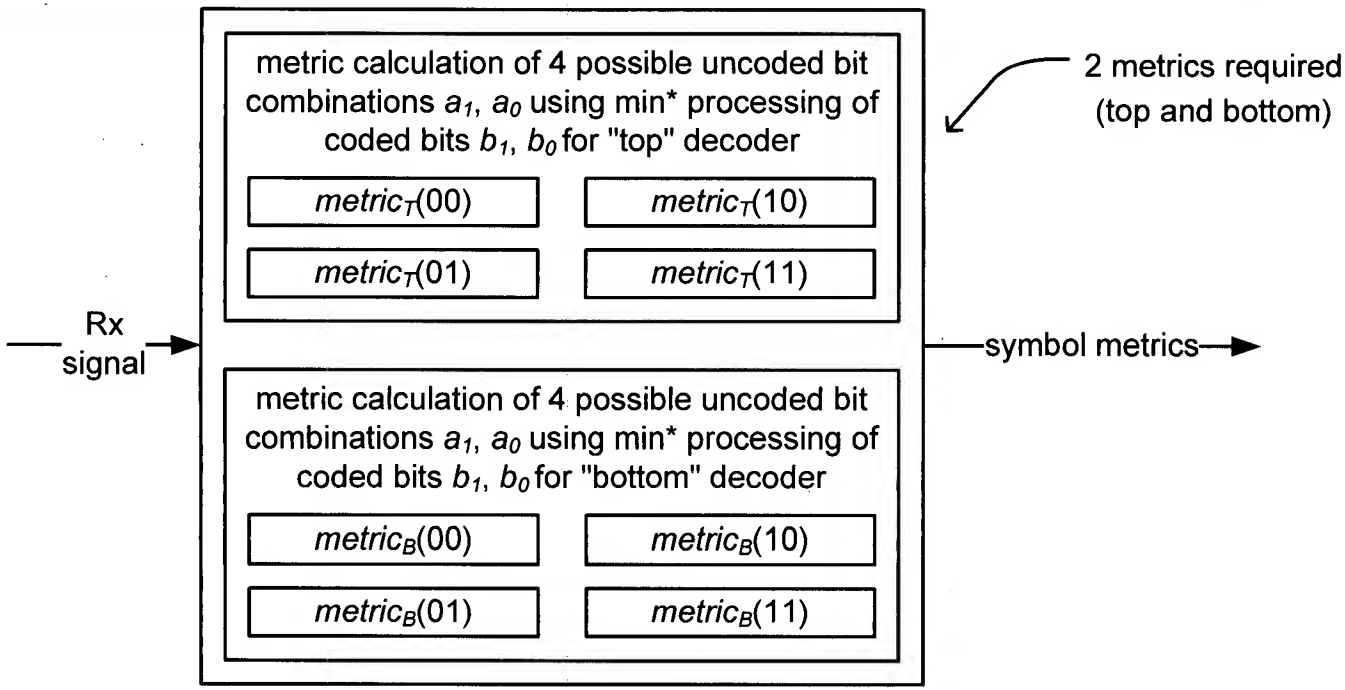
RC (Rate Control) governed symbol mapping to various constellations

Fig. 28B

bandwidth efficiency	a period of a sequence for 16 QAM	a period of a sequence for 16 APSK
3.33 bit/s/Hz	Q0 Q0 (Q5 Q5)	A0 A0 (A5 A5)
3.5 bit/s/Hz	Q0 Q0 (Q5 Q5) (Q5 Q5)	A0 A0 (A5 A5) (A5 A5)

periodic RC (Rate Control) sequences supporting TTCM supporting bandwidth efficiencies of at least 3 bit/s/Hz

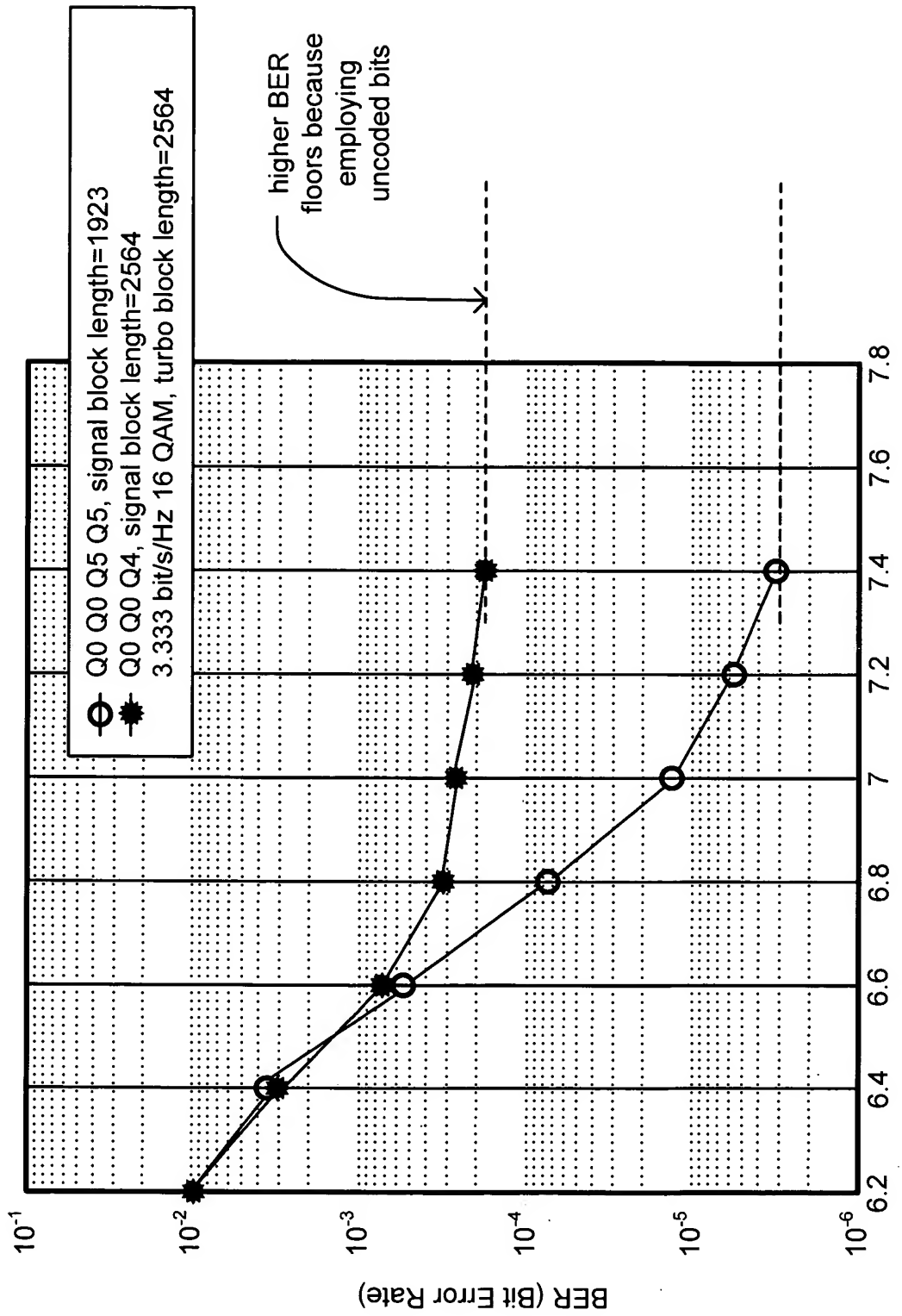
Fig. 29A



metric generator computation to accommodate RCs (Q5 Q5) and (A5 A5)

Fig. 29B

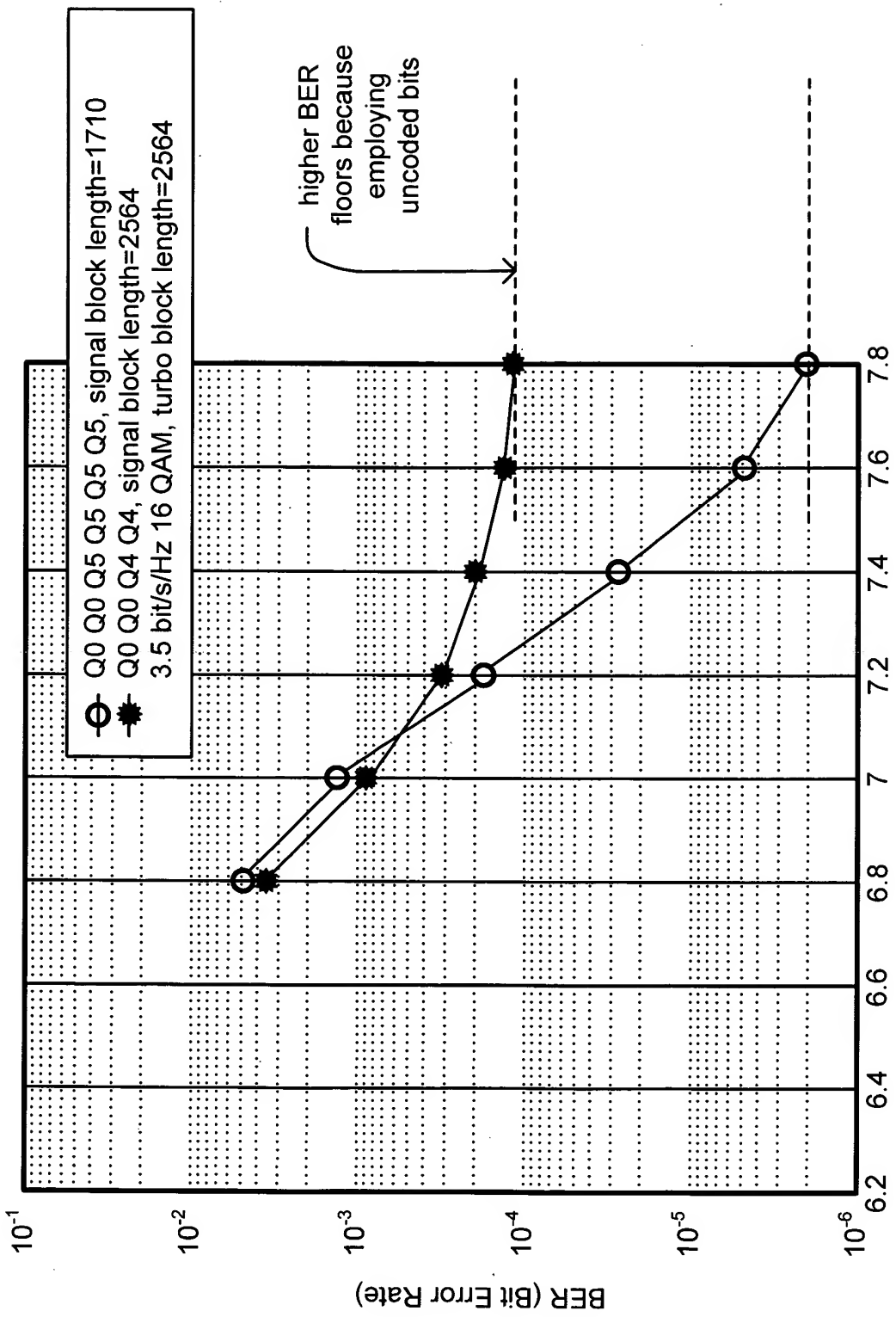
BP3018: Replacement Sheet



performance of 3.33 bit/s/Hz 16 QAM TTCM (shown with 4 decoding iterations)

Fig. 30

BP3018: Replacement Sheet



performance of 3.5 bit/s/Hz 16 QAM TTCM (shown with 4 decoding iterations)

Fig. 31

RC sequences include combined 16 QAM and QPSK (Q3) modulations

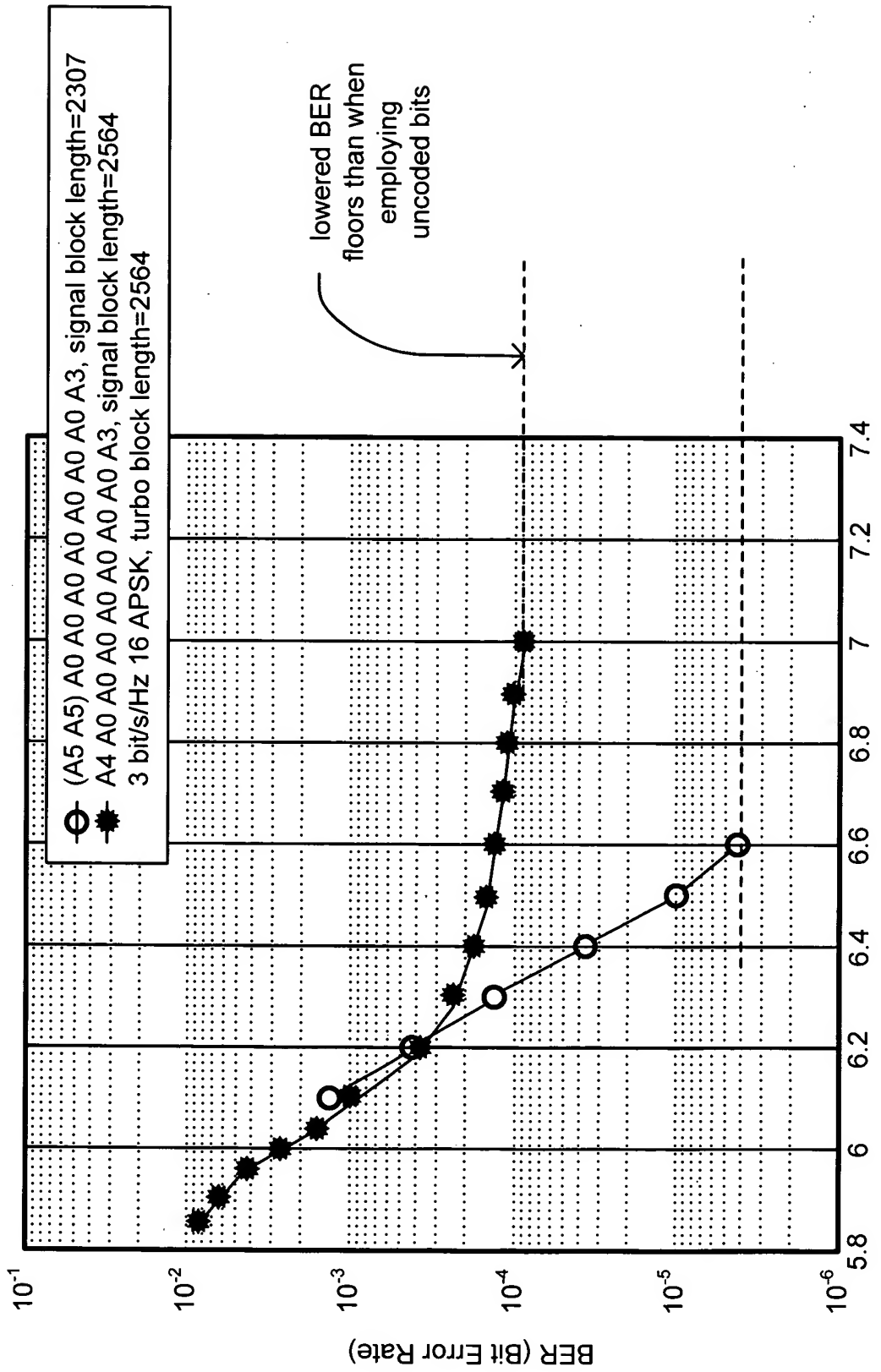
RC sequences include combined 16 APSK and QPSK (A3) modulations

bandwidth efficiency	a period of a sequence for 16 QAM (period 9)	a period of a sequence for 16 APSK (period 9)
3.0 bit/s/Hz	Q4 Q0 Q0 Q0 Q0 Q0 Q0 Q0 Q3, or (Q5 Q5) Q0 Q0 Q0 Q0 Q0 Q0 Q0 Q3	A4 A0 A0 A0 A0 A0 A0 A0 A3, or (A5 A5) A0 A0 A0 A0 A0 A0 A0 A3
3.11 bit/s/Hz	Q4 Q0 Q0 Q0 Q4 Q0 Q0 Q0 Q3, or (Q5 Q5) Q0 Q0 Q0 (Q5 Q5) Q0 Q0 Q0 Q3	A4 A0 A0 A0 A4 A0 A0 A0 A3, or (A5 A5) A0 A0 A0 (A5 A5) A0 A0 A0 A3
3.33 bit/s/Hz	Q4 Q4 Q0 Q0 Q4 Q4 Q0 Q0 Q3, or (Q5 Q5) (Q5 Q5) Q0 Q0 (Q5 Q5) (Q5 Q5) Q0 Q0 Q3	A4 A4 A0 A0 A4 A4 A0 A0 A3, or (A5 A5) (A5 A5) A0 A0 (A5 A5) (A5 A5) A0 A0 A3

combined modulation periodic RC sequences supporting TTCM supporting bandwidth efficiencies of at least 3 bit/s/Hz

Fig. 32

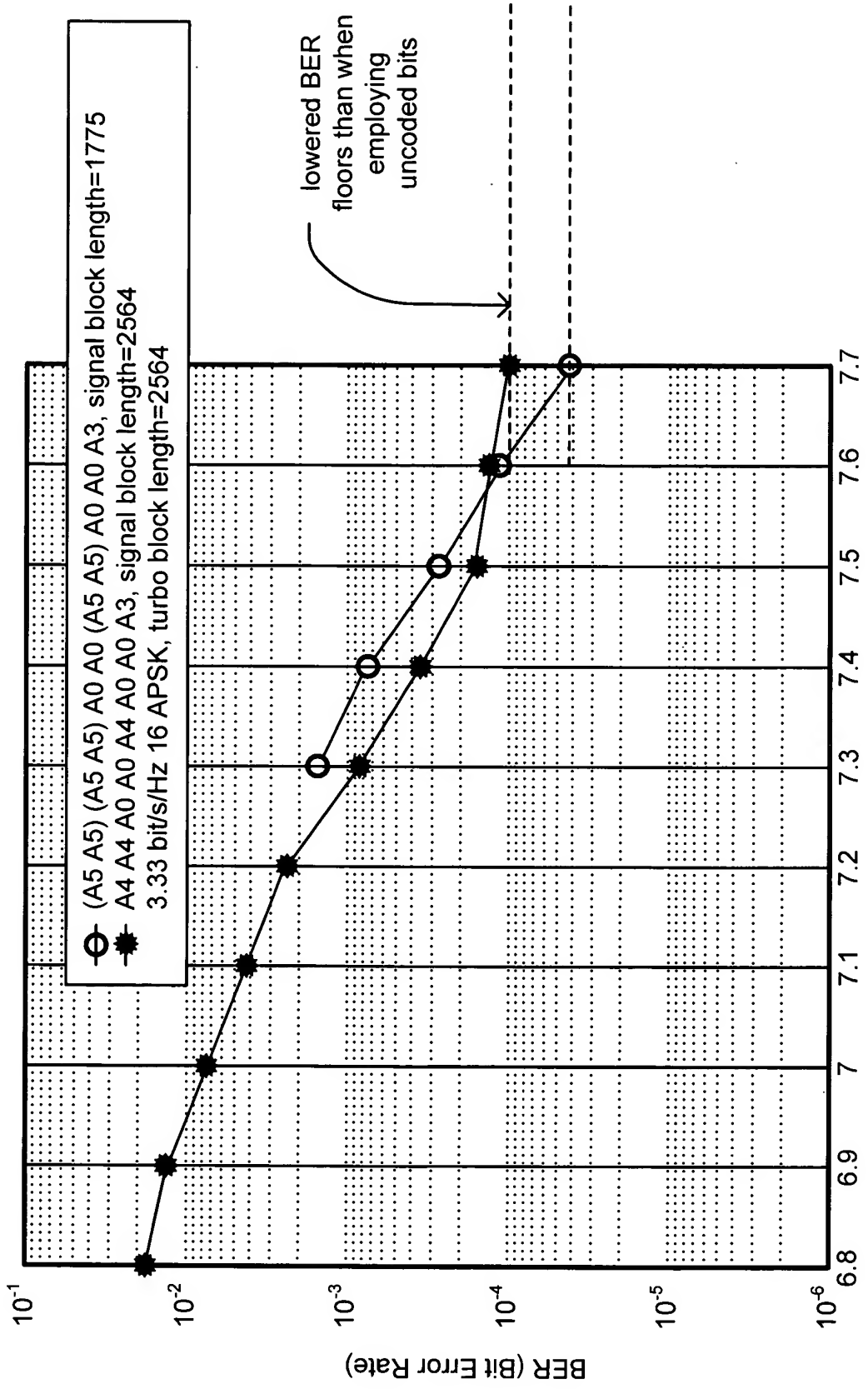
BP3018: Replacement Sheet



performance of 3.0 bit/s/Hz 16 APSK TTCM (shown with 4 decoding iterations)

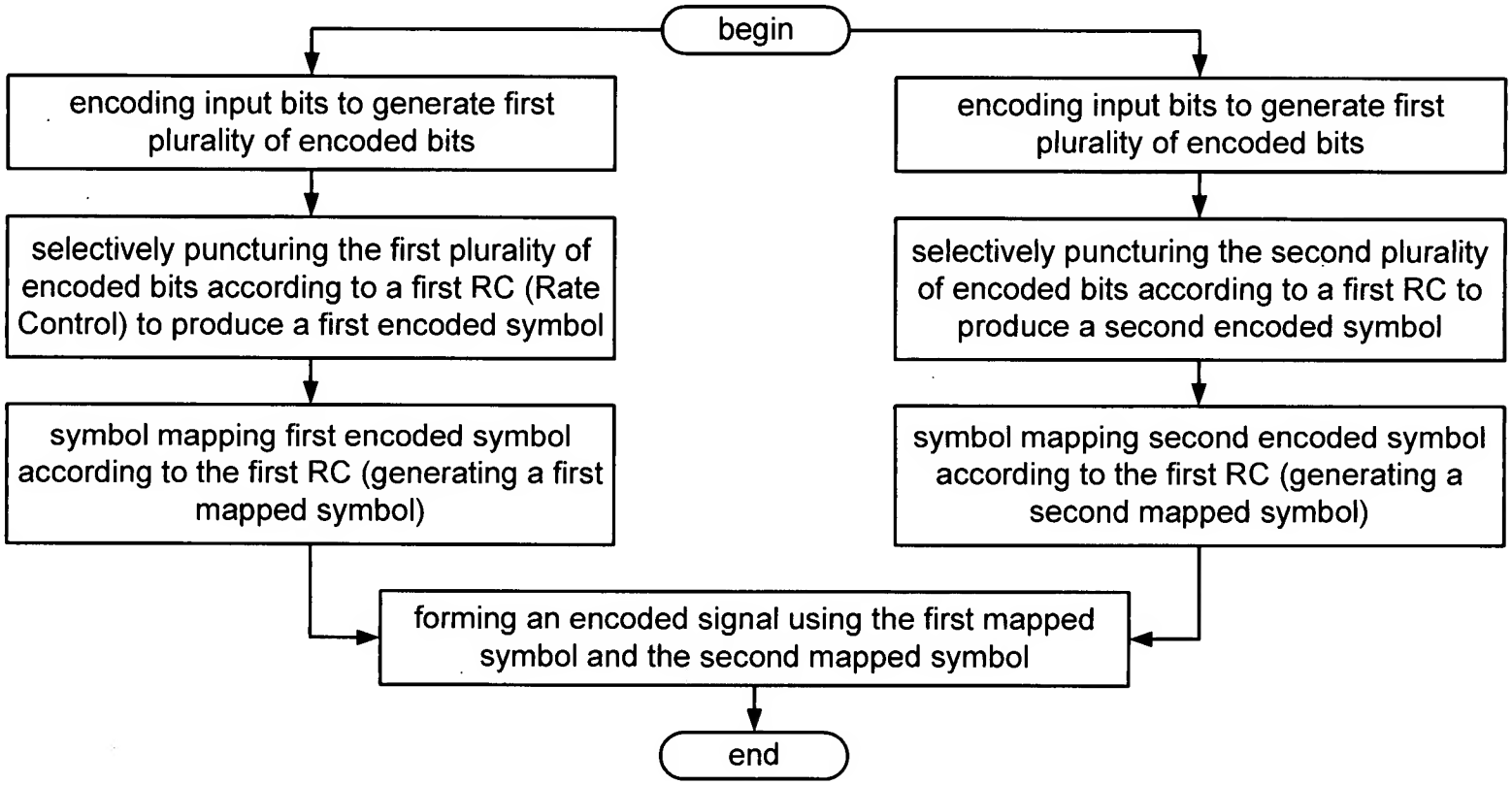
Fig. 33

BP3018: Replacement Sheet



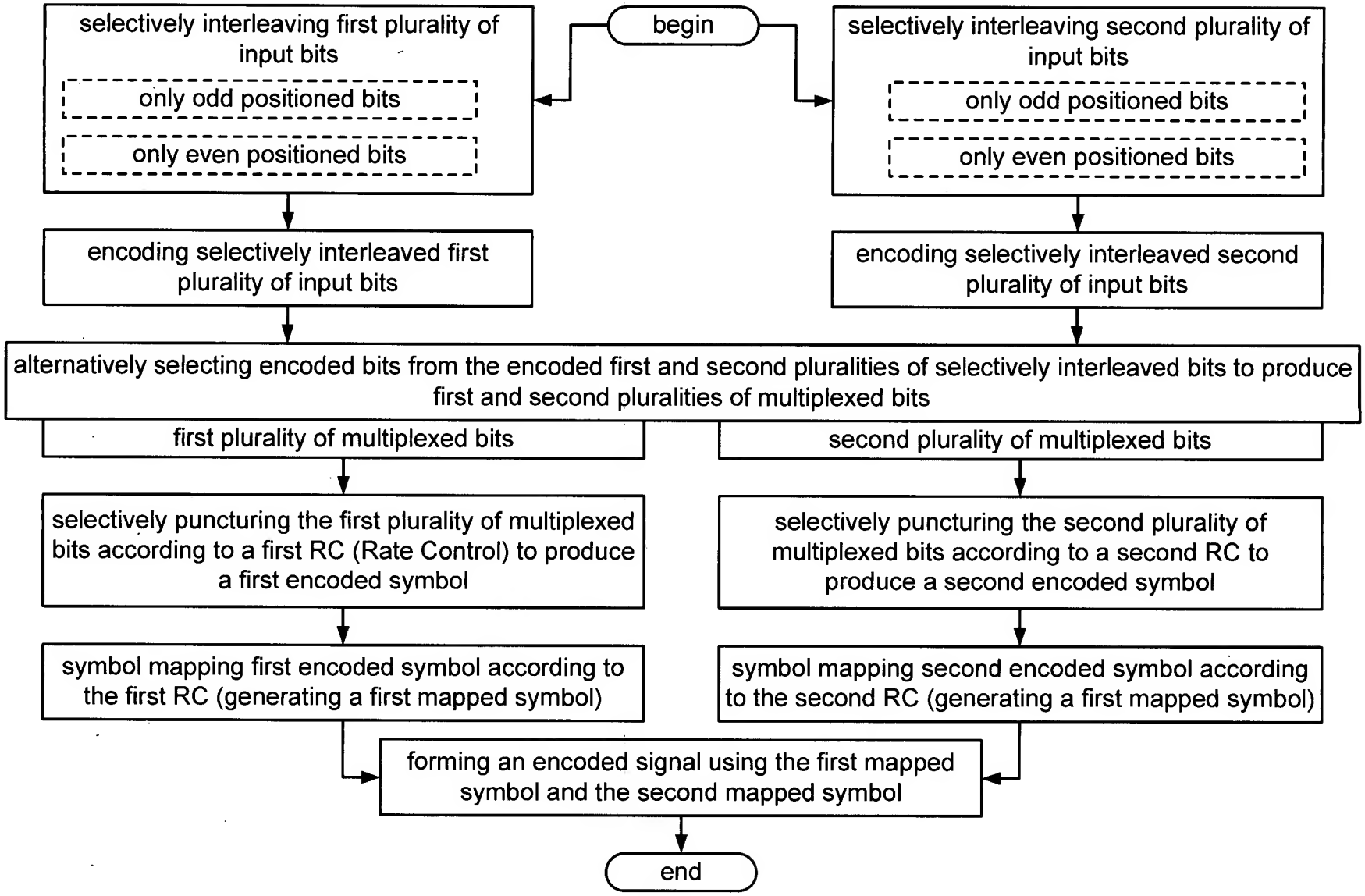
performance of 3.33 bit/s/Hz 16 APSK TTCM (shown with 4 decoding iterations)

Fig. 34



TTCM (Turbo Trellis Coded Modulation) encoding method

Fig. 35



TTCM (Turbo Trellis Coded Modulation) encoding method

Fig. 36